

DRAINAGE : MICHIGAN

STATISTICS FOR THE STATE AND ITS COUNTIES

Prepared under the supervision of WILLIAM LANE AUSTIN, Chief Statistician for Agriculture, by ROGER D. MARSDEN, Special Agent in Charge of Drainage

CONTENTS.

	Page.		Page.
INTRODUCTION.....	1	DRAINAGE ENTERPRISES—Continued.	
MAP SHOWING OPERATING DRAINAGE ENTERPRISES.....	2	Size of enterprises.....	4
DRAINAGE ON FARMS.....	3	Character of enterprises.....	5
Explanation of terms.....	3	Drainage works.....	6
Farms and farm land.....	3	Maintenance of works.....	7
DRAINAGE ENTERPRISES.....	3	Date of organization.....	7
Explanation of terms.....	3	Crops.....	7
Operating and nonoperating enterprises.....	4	COUNTY TABLES:	
Location of enterprises.....	4	I.—Drainage on farms: 1920.....	8
Condition of land in enterprises.....	4	II.—Operating drainage enterprises: 1920.....	10

INTRODUCTION.

This bulletin presents the statistics of drainage for Michigan collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. Drainage work done by organized enterprises before 1897, when the present county drain law was enacted, is not included. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of timber and other unim-

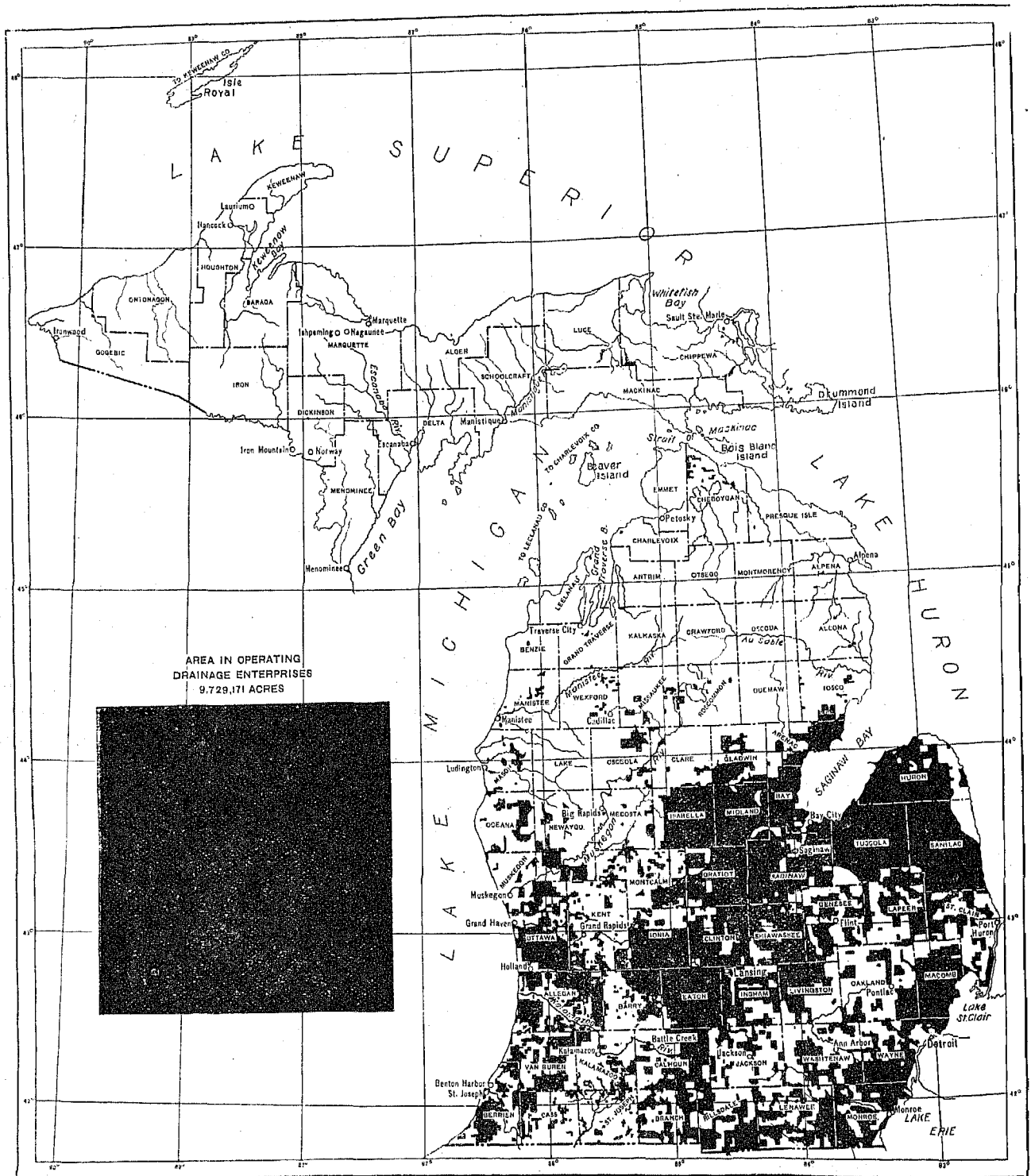
proved land not yet in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are given separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
DRAINAGE ON FARMS.		
Number of all farms in the state.....	196,447	100.0
Farms reporting land having drainage.....	66,948	34.1
Farms reporting land needing drainage.....	64,310	32.7
All land in farms..... acres..	19,032,961	100.0
Improved land in farms..... acres..	12,925,521	67.9
Farm land reported as provided with drainage..... acres..	3,156,632	16.6
Farm land reported as needing drainage..... acres..	2,070,387	10.9
DRAINAGE ENTERPRISES.		
Approximate land area of the state..... acres..	36,787,200	100.0
All land in operating drainage enterprises..... acres..	9,729,171	26.4
Improved land..... acres..	7,182,352	19.5
Timber and cut-over land..... acres..	2,195,562	6.0
Other unimproved land..... acres..	351,257	1.0
Total capital invested in and required for completion of operating enterprises...	\$25,048,980	100.0
Capital invested in these enterprises to Dec. 31, 1919.....	\$24,683,715	98.5
Additional capital required to complete these enterprises.....	\$365,265	1.5

MICHIGAN

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



DRAINAGE ON FARMS.

Explanation of terms.—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which are substantially as follows:

Drainage of agricultural land was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purpose of improving the condition of the soil and crops.

The area provided with drainage, in farms, is the acreage actually benefited or made of more value for agricultural purposes by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land not now suitable for crops which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators have answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual." Levee districts, however, generally are not included in the enterprises for which data are given in this bulletin (see definition of drainage enterprises, below).

Farms and farm land.—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for growing crops by reason of the drainage. This is to be distinguished from the area merely provided with outlet facilities by organized drainage enterprises. Drainage on farms represents in most cases the result of work done by the farm owner, either independently or supplemental to the work done by a drainage enterprise, but the acreage would include also any farm land receiving similar benefits directly from the works of an enterprise.

DRAINAGE ENTERPRISES.

Explanation of terms.—The more important terms used in connection with the census of drainage enterprises were defined as follows:

Drainage enterprises comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swamp or overflowed land for sale, other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditches or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise, though the capacities of drainage pumping plants are given only in the counties in which the plants are located.

Operating enterprises, as designated in this bulletin, are those that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

Land in drainage enterprises comprises the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises, deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (a) improved land; (b) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (c) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be considerably greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprises.

Timber and cut-over land includes farm woodland of natural or

planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, land subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering loss of crops is intended to include only land devoted to planted crops which suffer damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A pumping district is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence. They may include those that on the census date had completed their plans, sold bonds to cover the cost of the undertaking, and let contracts for the construction work, and also others that had just been established and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. ¹		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	9,754,679	100.0	\$24,686,729	100.0	\$537,645
Operating enterprises.....	9,729,171	99.7	24,683,715	100.0	365,265
With works completed.....	9,511,555	97.5	24,100,929	97.6	
With works under construction.	217,616	2.2	582,786	2.4	365,265
Nonoperating enterprises.....	25,508	0.3	3,014	(²)	172,380

¹ The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

² Less than one-tenth of 1 per cent.

Location of enterprises.—The drainage enterprises in Michigan are located almost entirely in the 47 southern counties which comprise approximately two-thirds of the southern peninsula. The division between the southern section, in which a large part of the land has been included in drainage enterprises and the northern section where little drainage has been done, is remarkably sharp, as shown by the map on page 2.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	9,754,679	100.0	\$24,686,729	100.0	\$537,645
Operating enterprises.....	9,729,171	99.7	24,683,715	100.0	365,265
Lake Superior.....	18,424	0.2	66,731	0.3	
Lake Michigan.....	3,937,263	40.4	9,058,920	36.7	74,943
Lake Huron.....	4,133,145	42.4	11,948,569	48.4	221,174
Lake Erie.....	1,640,339	16.8	3,609,495	14.6	69,148
Nonoperating enterprises.....	25,508	0.3	3,014	(¹)	172,380
Lake Michigan.....	17,755	0.2	2,532	(¹)	30,020
Lake Huron.....	6,065	0.1	482	(¹)	83,500
Lake Erie.....	1,688	(¹)			8,260

¹ Less than one-tenth of 1 per cent.

Condition of land in enterprises.—The greater number of enterprises was reported as organized to reclaim or improve land that was swampy or too wet for profitable cultivation. The smaller number, located mainly in the southwestern part of the state, was reported as intended to secure relief for land subject to overflow by stream floods. Prior to undertaking the drainage improvements, approximately 21 per cent of the total area in drainage enterprises was improved land and 70 per cent timbered or cut-over, while about 49 per cent was reported as being then swampy, subject to overflow, or too wet for cultivation.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflow for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the drainage improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	9,729,171	100.0	9,511,555	217,616	25,508
Improved land.....	7,182,352	73.8	7,015,044	166,708	8,245
Timber and cut-over land.....	2,195,502	22.6	2,149,662	45,910	15,039
Other unimproved land.....	351,257	3.6	346,259	4,998	2,224
Swampy or subject to overflow.....	1,020,207	10.5	987,216	32,991	12,316
Suffering a loss of crops.....	692,224	7.1	676,337	15,887	1,458

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided and the part in each county be considered a separate enterprise. In this way 10,453 operating drainage enterprises are counted in Michigan, from 1897 to 1919, with an average area of 1,508 acres assessed. There are 4,196 of these enterprises embracing less than 500 acres each, 5,970 between 500 and 5,000 acres, and 287 of 5,000 acres or over.

The assessed acreage exceeds the land in enterprises by 6,037,307 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed acreage, deduction was made for the amount of overlapping with enterprises organized previously, to determine the acreage to be tabulated as land in enterprises.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

AREA ASSESSED.	Land in enterprises (acres).	ASSESSED AREA.	
		Acres.	Per cent of total.
All operating enterprises.....	9,729,171	15,766,478	100.0
Less than 200 acres.....	109,428	155,089	1.0
200 to 499 acres.....	648,405	967,221	6.1
500 to 999 acres.....	1,232,901	1,849,136	11.7
1,000 to 4,999 acres.....	5,359,782	7,902,624	50.1
5,000 to 9,999 acres.....	2,059,229	3,251,318	20.6
10,000 to 49,999 acres.....	199,256	1,072,885	6.8
50,000 to 99,999 acres.....	120,170	568,205	3.6

Character of enterprises.—Nearly all the drainage enterprises in Michigan for which statistics are given, except the few commercial land developments and private undertakings by individual owners, are county drains established in accordance with the provisions of the general drainage law approved June 2, 1897 (act 254). That statute repealed all previous drainage laws of the state, but drains previously established under act 227 of 1885 might be completed under it.

The census did not undertake to secure information relating to the drains established before 1897, in Michigan, because the records regarding them were very fragmentary or entirely lacking, except in a few counties. The statistics do include, however, as shown by Table 6, figures for drains established in that year under the earlier law.

The drainage law of 1897, as amended, provides for a county drain commissioner to be elected every two years by the qualified electors, in every organized county in the state. This commissioner is to have jurisdiction over all drains within his county, but drains affecting land in more than one county are under joint jurisdiction of the commissioners of all those counties. Appointment of a special drain commissioner, in case the elected commissioner has an interest in the assessment of benefits, is authorized by statutes of 1901 (act 27) and 1917 (act 109).

An application for a drain must be signed by not less than one-half the freeholders through whose land the drain will pass. The necessity and public utility of the enterprise are determined by the township board or boards of the township or townships in which the drain is to be located, after public hearing. Upon favorable finding, a survey is made by the drain commissioner or a surveyor employed by him, and if the improvement is found practicable the commissioner issues a first order of determination establishing the location and dimensions of the drain. Appeal from this order may be taken to the probate court of the county, and an engineer appointed by the state highway commissioner investigates and decides the necessity and route for the drain. Land for right of way is secured by release or by condemnation proceedings before the probate court. Damages are

determined by three special commissioners appointed by the court or, upon demand, by a jury. Final order of determination is issued by the drain commissioner when right of way has been obtained, defining the special assessment district that shall bear the cost of the undertaking. The cost is apportioned according to benefits assessed by the drain commissioner and determined by him at public hearing. Any township may be assessed for benefits to public health and welfare or for benefits to highways. The assessments are subject to review by three disinterested freeholders appointed by the probate court. The award of damages to each landowner is deducted from his assessment of benefits. Contracts for construction are let by the drain commissioner. The number of installments in which the landowners shall pay their assessments is determined by the drain commissioner, who is authorized by an act of March 18, 1919 (No. 16), to issue bonds for not exceeding 10 years if the number of installments exceeds three. For a drain to be located or to affect land in more than one county, application may be filed with the drain commissioner of any county affected. Proceedings are similar to those for a drain in only one county, but are under the joint control of the drain commissioners of all the counties affected. Also, the necessity for the drain is determined by the drain commissioners instead of by the township boards; in case of disagreement, the state highway commissioner decides.

As originally enacted, the drainage law provided for appointment of the county drain commissioner by the county board of supervisors. The petition for a drain then required the signatures of 10 or more freeholders of the township or townships, including at least 3 liable to assessment for the drain.

Before 1909, the necessity for the drain was determined by the drain commissioner instead of by the township board, and appeals regarding apportionment of benefits were decided by that board.

A few other statutes relating to drainage have been enacted since 1897, which do not affect the character of enterprises as described.

A law of June 20, 1885 (act 227), provided for township and county drain commissioners, the former to be elected and the latter to be appointed by the county board of supervisors. The jurisdiction of the township commissioners was limited to drains located wholly within their respective townships and each affecting land in no other township. The county commissioners were given concurrent jurisdiction with township commissioners for drains wholly within one township, and jurisdiction over the other drains in the county. Drains were located upon petition from five or more freeholders, at least one of whom owned land liable to be assessed for benefits. The drain commissioner determined the necessity and

location for the drain, apportioned the cost, and let contracts for construction. Right of way was secured by voluntary release or by proceedings before the probate court. Drains located or benefiting land in more than one county were under the joint control of the drain commissioners for the counties affected. This act was repealed by the drainage law of 1897.

The first general drainage law of this state was enacted in 1839 (ch. 80), providing means for one landowner to secure drainage outlet across the land of an objecting owner through application to a justice of the peace and payment of damages assessed by a jury. An act of 1847 (No. 104) authorized each board of county commissioners to appoint three drainage commissioners to secure the drainage of the marshes and lowland of the county. The plans and estimates for each project must be approved by the county court. The cost was apportioned by the commissioners against the land to be benefited, subject to review by three appraisers and confirmation by the court. In 1859 it was provided (act 178) that the drainage commissioners should make surveys for drainage upon petition from 10 resident freeholders. These and other drainage laws were repealed by that of 1897.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.			
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.	
			Amount.	Per cent of total.		
All organized enterprises.....	9,754,679	100.0	\$24,686,729	100.0	\$537,645	
Operating enterprises.....	9,729,171	99.7	24,683,715	100.0	365,265	
County drains.....	9,706,891	99.5	24,434,715	99.0	365,265	
Laws of 1885, act 227.....	53,273	0.5	65,242	0.3		
Laws of 1897, act 254.....	9,649,392	98.9	24,363,246	98.7	361,765	
Not reported.....	4,516	(1)	6,227	(1)	3,500	
Commercial developments.....	10,930	0.1	199,500	0.8		
Individual ownerships.....	11,320	0.1	49,500	0.2		
Nonoperating enterprises.....	25,508	0.3	3,014	(1)	172,380	
County drains, laws of 1897.....	25,508	0.3	3,014	(1)	172,380	

¹ Less than one-tenth of 1 per cent.

Drainage works.—The total works completed by the drainage enterprises to December 31, 1919, comprised 16,023.8 miles of open ditches, 2,173.9 miles of tile drains, and 33.1 miles of accessory levees; the additional lengths under construction were 118.4 miles of ditches and 8.4 miles of tile drains. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood protection or levee districts that had not undertaken the construction of ditches or tile drains. There are three pumping districts for land drainage among the enterprises in Michigan, which have completed con-

struction. The pumping plants are equipped with 7 centrifugal pumps of 62,000 gallons per minute total capacity and are operated by steam power.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	9,729,171	100.0	\$24,683,715	100.0	\$365,265
Open ditches only.....	8,541,556	87.8	18,698,883	75.8	342,512
Open ditches and levees.....	2,000	(1)	176,284	0.7	
Tile drains only.....	318,514	3.3	2,270,188	9.2	16,868
Open ditches and tile drains.....	867,101	8.9	3,538,360	14.3	5,785

¹ Less than one-tenth of 1 per cent.

TABLE 8.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY TYPE OF DRAINAGE: 1920.

TYPE OF DRAINAGE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	9,729,171	100.0	\$24,683,715	100.0	\$365,265
Gravity drainage only.....	9,718,471	99.9	24,513,276	99.3	365,265
All drainage by pumping.....	1,100	(1)	22,139	0.1	
Part gravity and part pumping.....	9,600	0.1	148,300	0.6	
Total area served by pumps.....	10,100	0.1			

¹ Less than one-tenth of 1 per cent.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches, which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet and those 10 feet and over were omitted, as it seemed they did not represent so well the average depths of outlet provided for all the farms in those districts; to include both of these groups, computed as 3 feet and 10 feet, respectively, would show the mean depth for the state 4.2 instead of 4.3 feet.

TABLE 9.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	9,729,171	100.0
Less than 3 feet.....	89,345	0.9
3.0 to 3.9 feet.....	472,542	4.9
4.0 to 4.9 feet.....	773,674	8.0
5.0 to 5.9 feet.....	337,024	3.5
6.0 to 6.9 feet.....	125,383	1.3
7.0 to 7.9 feet.....	115,603	1.2
8.0 to 8.9 feet.....	15,500	0.2
9.0 to 9.9 feet.....	2,844	(¹)
10 feet and over.....	1,280	(¹)
Not reporting branches.....	7,795,976	80.1

¹ Less than one-tenth of 1 per cent.

Maintenance of works.—For cleaning out, deepening, widening, and straightening county drains in this state, proceedings are similar to those for securing construction of a new drain, the cost being paid by the land benefited by this work. The petition for cleaning out a drain requires only the signatures of five freeholders of the township or townships in which the drain is located, one or more of whom shall own land liable to be assessed. However, an act of May 10, 1917 (No. 316), provides that upon written request from one or more taxpayers on any drain the county drain commissioner, where he deems that an emergency exists threatening crops or property, may expend not more than 10 per cent of the original cost of the drain.

For cleaning out, deepening, widening, and extending a drain previously constructed in more than one county, application shall be made, according to a statute of May 3, 1919 (act 162), by freeholders numbering at least 10 per cent of those assessed for construction of the drain and who shall be owners of land that was assessed for the construction.

TABLE 10.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.			
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.	
			Amount.	Per cent of total.		
All operating enterprises.....	9,729,171	100.0	\$24,683,715	100.0	\$365,265	
By district forces.....	3,200	(¹)	44,261	0.2	1,790	
By contract.....	1,872,052	19.2	4,768,980	19.3	38,964	
By landowners.....	9,280	0.1	189,490	0.7	.....
No maintenance provided.....	7,243,624	74.5	18,781,212	76.1	286,393	
Not reporting.....	601,015	6.2	919,772	3.7	38,118	

¹ Less than one-tenth of 1 per cent.

Date of organization.—The progress of development in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the drains were established by the county drain commissioners, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work

of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of drainage was completed.

TABLE 11.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	9,729,171	100.0	15,766,478	100.0
1897 to 1899.....	1,151,008	11.8	1,463,231	9.3
1900 to 1904.....	2,703,584	28.4	3,846,251	24.4
1905 to 1909.....	2,358,660	24.2	3,886,383	24.6
1910 to 1914.....	1,900,100	19.5	3,409,884	22.2
1915 to 1919.....	1,535,174	15.8	3,043,271	19.3
Not reported.....	19,985	0.2	27,458	0.2

TABLE 12.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$24,683,715	100.0	\$365,265
1897 to 1899.....	2,017,054	8.2	.....
1900 to 1904.....	5,724,176	23.2	.....
1905 to 1909.....	5,543,364	22.5	.....
1910 to 1914.....	5,315,603	21.5	.....
1915 to 1919.....	6,013,764	24.4	365,265
Not reported.....	60,754	0.3	.....

TABLE 13.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		DRAINS.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	16,142.2	100.0	2,182.3	100.0	33.1	100.0
1897 to 1899.....	1,637.2	10.1	84.4	3.9	6.0	18.1
1900 to 1904.....	4,542.3	28.1	274.9	12.6	27.0	81.6
1905 to 1909.....	4,330.9	26.8	321.1	14.7	0.1	0.3
1910 to 1914.....	3,373.8	20.9	746.7	34.2	.....	.....
1915 to 1919.....	2,224.0	13.8	750.8	34.4	.....	.....
Not reported.....	34.0	0.2	4.4	0.2	.....	.....

Crops.—The principal crops grown upon the drained land in drainage enterprises are wheat, corn, and sugar beets. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE—MICHIGAN.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Alcona.	Allegan.	Alpena.	Arenac.	Barry.	Bay.	Berrien.	Branch.
1	Number of all farms in the state or county.....	196,447	932	5,734	1,275	1,392	3,313	3,216	5,443	3,222
2	Farms reporting land having drainage.....	66,948	26	982	39	195	158	1,854	469	1,333
3	Farms reporting land needing drainage.....	64,310	228	889	541	299	170	1,270	174	1,309
4	Farms in drainage and levee districts.....	23,356	4	309	3	29	7	458	95	566
LAND AND FARM AREA.										
5	Approximate land area of the state or county.....acres..	36,787,200	437,760	533,120	373,760	239,360	355,840	283,520	304,160	318,080
6	All land in farms.....acres..	19,032,961	131,388	436,616	153,729	135,334	332,369	227,932	326,600	308,805
7	Improved land in farms.....acres..	12,025,521	49,577	327,395	63,237	72,851	245,983	167,998	262,917	227,781
8	Woodland in farms.....acres..	3,217,000	32,993	46,849	50,243	49,220	42,617	43,725	32,533	27,123
9	Other unimproved land in farms.....acres..	2,890,440	48,813	62,372	40,249	13,263	48,769	16,209	31,140	53,091
10	Farm land reported as provided with drainage.....acres..	3,156,632	878	26,686	766	8,225	4,376	92,782	23,802	42,281
11	Farm land reported as needing drainage.....acres..	2,070,387	10,399	19,738	28,770	14,199	2,765	37,434	2,656	32,587
12	Drainage only.....acres..	679,813	1,582	6,004	7,364	3,888	1,126	7,948	855	18,049
13	Drainage and clearing.....acres..	1,490,574	14,817	13,734	21,406	10,311	1,639	29,486	1,801	13,938

		Calhoun.	Cass.	Cheboygan.	Chippewa.	Clare.	Clinton.	Delta.	Eaton.	Genesee.
1	Number of all farms in the county.....	3,646	2,572	1,186	1,569	1,248	3,323	1,395	3,719	3,639
2	Farms reporting land having drainage.....	928	82	37	73	187	1,932	139	2,621	2,291
3	Farms reporting land needing drainage.....	1,067	158	253	578	823	1,407	531	1,674	2,020
4	Farms in drainage and levee districts.....	477	43	1	2	25	944	31	1,028	513
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	443,520	315,520	464,000	1,006,720	372,480	365,440	748,160	365,440	419,200
6	All land in farms.....acres..	407,958	286,991	127,197	185,202	186,581	343,955	142,137	342,600	368,520
7	Improved land in farms.....acres..	301,566	219,426	55,937	105,870	65,801	275,734	53,021	263,959	291,624
8	Woodland in farms.....acres..	38,449	38,302	38,921	68,783	67,610	47,496	53,821	32,351	38,336
9	Other unimproved land in farms.....acres..	67,943	29,263	32,339	10,549	53,170	20,735	35,296	46,190	38,560
10	Farm land reported as provided with drainage.....acres..	30,337	1,759	899	3,282	5,225	84,302	2,851	123,106	151,901
11	Farm land reported as needing drainage.....acres..	28,105	3,803	13,581	28,840	69,183	31,584	22,939	37,343	54,353
12	Drainage only.....acres..	14,328	1,933	323	1,368	2,144	12,828	2,859	16,049	18,474
13	Drainage and clearing.....acres..	13,777	1,870	13,258	27,472	67,039	18,750	20,080	21,294	35,879

		Gladwin.	Grand Traverse.	Gratiot.	Hillsdale.	Houghton.	Huron.	Ingham.	Ionia.	Iosco.	Isabella.
1	Number of all farms in the county.....	1,452	1,725	3,859	4,025	1,741	4,604	3,224	3,223	929	3,333
2	Farms reporting land having drainage.....	566	82	2,813	2,755	134	1,267	2,295	1,552	170	1,701
3	Farms reporting land needing drainage.....	843	332	2,287	1,974	225	1,419	1,541	1,403	429	1,995
4	Farms in drainage and levee districts.....	461	10	2,196	773	2	808	562	401	44	1,118
LAND AND FARM AREA.											
5	Approximate land area of the county.....acres..	332,160	298,880	370,560	382,080	652,160	546,560	353,920	370,560	364,800	366,080
6	All land in farms.....acres..	154,633	170,188	328,074	362,815	134,790	480,988	323,196	344,102	121,694	310,771
7	Improved land in farms.....acres..	73,001	113,852	251,326	283,071	56,798	383,581	238,492	266,698	40,673	211,812
8	Woodland in farms.....acres..	30,703	35,000	37,116	38,190	55,812	35,687	31,482	34,877	30,020	34,524
9	Other unimproved land in farms.....acres..	50,809	21,330	39,632	41,554	22,180	58,717	53,222	42,527	35,101	70,435
10	Farm land reported as provided with drainage.....acres..	28,697	1,001	127,510	127,028	3,654	83,953	98,700	63,963	5,890	62,330
11	Farm land reported as needing drainage.....acres..	49,127	5,494	79,440	38,048	13,396	43,456	43,840	29,905	27,324	62,680
12	Drainage only.....acres..	631	1,082	33,508	17,352	660	2,639	27,406	12,578	1,723	12,882
13	Drainage and clearing.....acres..	48,496	4,412	45,932	20,696	12,736	40,767	16,374	17,327	25,601	40,798

		Jackson.	Kalamazoo.	Kent.	Lapeer.	Leelanau.	Lena- wee.	Living- ston.	Ma- comb.	Man- istee.	Mar- quette.
1	Number of all farms in the county.....	3,544	3,161	5,605	3,614	1,347	5,080	2,632	3,570	1,499	846
2	Farms reporting land having drainage.....	1,103	543	1,424	1,897	28	4,136	1,119	2,510	149	49
3	Farms reporting land needing drainage.....	1,335	442	1,589	1,778	252	2,678	633	1,121	378	157
4	Farms in drainage and levee districts.....	253	143	285	587	.....	1,088	110	553	8	1
LAND AND FARM AREA.											
5	Approximate land area of the county.....acres..	452,480	359,680	550,400	426,240	216,320	475,520	363,520	302,080	359,680	1,196,800
6	All land in farms.....acres..	411,677	311,934	469,924	395,932	165,399	466,708	333,339	272,357	147,569	88,450
7	Improved land in farms.....acres..	205,871	247,905	352,740	291,706	90,825	370,047	231,346	221,453	85,202	27,044
8	Woodland in farms.....acres..	49,733	27,565	66,204	43,022	60,657	46,186	41,135	30,006	41,233	43,140
9	Other unimproved land in farms.....acres..	72,073	36,464	50,980	61,204	13,917	40,475	60,858	20,898	21,044	17,366
10	Farm land reported as provided with drainage.....acres..	31,241	12,001	32,150	86,678	639	240,797	40,228	129,008	1,877	899
11	Farm land reported as needing drainage.....acres..	35,968	13,099	33,485	52,005	14,799	60,930	20,053	21,332	9,915	8,459
12	Drainage only.....acres..	21,920	4,865	12,636	15,358	1,608	27,822	14,418	8,687	1,796	893
13	Drainage and clearing.....acres..	14,048	8,234	20,849	36,647	13,191	39,108	5,635	12,645	8,119	7,566

DRAINAGE—MICHIGAN.

9

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Mason.	Mecosta.	Menominee.	Midland.	Missaukee.	Monroe.	Montcalm.	Montmorency.	Muskegon.	
1	Number of all farms in the county.....	2,011	2,676	2,106	2,163	1,359	4,108	4,493	421	2,036	
2	Farms reporting land having drainage.....	711	267	63	1,292	79	3,442	965	40	760	
3	Farms reporting land needing drainage.....	822	1,255	1,358	1,449	524	1,870	1,890	242	699	
4	Farms in drainage and levee districts.....	228	94	3	1,215	70	693	532	.....	354
LAND AND FARM AREA.											
5	Approximate land area of the county.....acres..	316,160	365,440	675,840	338,560	372,480	366,720	463,360	359,040	322,560	
6	All land in farms.....acres..	183,428	281,574	222,353	202,027	168,710	318,845	396,333	55,212	173,518	
7	Improved land in farms.....acres..	108,180	165,492	85,305	108,762	78,386	271,485	269,145	22,801	107,679	
8	Woodland in farms.....acres..	46,145	51,011	68,063	29,809	26,030	30,245	54,681	26,811	38,830	
9	Other unimproved land in farms.....acres..	29,103	65,071	68,985	64,356	64,294	17,115	72,507	5,600	27,009	
10	Farm land reported as provided with drainage.....acres..	19,784	4,823	1,079	53,870	11,100	201,397	27,289	1,407	39,184	
11	Farm land reported as needing drainage.....acres..	28,640	40,111	53,321	72,010	34,942	48,840	45,515	17,277	23,492	
12	Drainage only.....acres..	2,307	5,601	1,979	13,591	1,486	28,999	11,139	917	3,794	
13	Drainage and clearing.....acres..	26,333	34,510	51,342	58,428	33,456	19,841	34,376	16,360	19,698	
		Nowaygo.	Oakland.	Oceana.	Ogemaw.	Ontonagon.	Osceola.	Ottawa.	Roscommon.	Saginaw.	St. Clair.
1	Number of all farms in the county.....	2,836	4,085	2,357	1,281	917	2,310	4,296	267	5,143	4,159
2	Farms reporting land having drainage.....	681	1,757	188	19	30	292	1,738	13	1,634	1,659
3	Farms reporting land needing drainage.....	1,060	1,646	43	575	111	993	885	125	1,221	1,155
4	Farms in drainage and levee districts.....	250	301	22	6	63	411	8	924	553
LAND AND FARM AREA.											
5	Approximate land area of the county.....acres..	544,640	567,040	347,520	371,200	853,120	369,280	361,600	344,320	529,920	454,400
6	All land in farms.....acres..	317,091	462,018	231,030	166,463	80,170	259,180	308,872	51,349	429,649	395,921
7	Improved land in farms.....acres..	187,559	340,567	150,118	67,052	25,025	147,382	238,248	10,419	317,270	311,491
8	Woodland in farms.....acres..	87,853	55,840	48,347	72,905	44,433	42,884	29,446	31,115	53,355	46,912
9	Other unimproved land in farms.....acres..	61,079	65,611	32,565	26,410	10,712	68,864	41,178	9,815	59,044	37,518
10	Farm land reported as provided with drainage.....acres..	25,834	66,741	5,176	2,177	510	7,354	71,082	586	90,120	126,975
11	Farm land reported as needing drainage.....acres..	34,215	38,074	773	32,925	3,012	31,451	17,099	32,048	48,759	31,810
12	Drainage only.....acres..	5,995	10,078	585	723	27	4,205	7,057	2,011	19,853	9,196
13	Drainage and clearing.....acres..	28,220	18,996	188	32,202	2,985	27,246	10,042	30,037	28,906	22,614
		St. Joseph.	Sanilac.	Shiawassee.	Tuscola.	Van Buren.	Washtenaw.	Wayne.	Wexford.	All other counties. ¹	
1	Number of all farms in the county.....	2,436	5,112	3,350	4,658	4,662	3,550	3,858	1,583	12,418	
2	Farms reporting land having drainage.....	108	2,148	2,107	2,467	872	1,210	2,378	37	252	
3	Farms reporting land needing drainage.....	161	1,242	1,555	1,079	594	954	1,038	511	2,171	
4	Farms in drainage and levee districts.....	17	729	746	871	238	237	742	21	21	
LAND AND FARM AREA.											
5	Approximate land area of the county.....acres..	321,920	624,640	356,480	529,280	394,880	450,560	396,800	369,280	8,873,600	
6	All land in farms.....acres..	202,038	540,839	320,616	445,260	341,089	421,211	262,204	146,712	1,314,855	
7	Improved land in farms.....acres..	284,521	454,204	258,781	335,519	260,009	318,748	213,443	88,408	569,409	
8	Woodland in farms.....acres..	23,981	39,759	26,816	43,913	40,312	46,286	30,333	29,169	485,917	
9	Other unimproved land in farms.....acres..	33,536	55,876	35,019	65,828	34,768	56,177	18,518	29,135	259,529	
10	Farm land reported as provided with drainage.....acres..	4,810	168,750	109,115	129,591	22,476	67,819	108,978	738	4,509	
11	Farm land reported as needing drainage.....acres..	3,543	37,324	40,414	59,606	14,193	23,636	30,969	17,636	95,709	
12	Drainage only.....acres..	1,896	9,196	25,794	20,313	3,954	13,271	20,029	504	8,017	
13	Drainage and clearing.....acres..	1,647	28,128	14,020	39,293	10,239	10,365	10,940	17,132	87,692	

¹ No drainage on farms reported in Luce County.

DRAINAGE—MICHIGAN.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Allegan.	Arenac.	Barry.	Bay.	Berrien.	Branch.	Calhoun.	Cass.
LAND AREA.										
1	Approximate land area of the state or county.....	acres.. 36,787,200	533,120	239,360	355,840	283,520	364,160	318,080	443,520	315,520
2	All land in operating drainage enterprises.....	acres.. 9,729,171	312,915	143,734	143,508	241,501	122,877	148,460	252,397	64,027
3	Improved land.....	acres.. 7,182,352	298,843	158,386	116,347	160,748	97,743	77,102	191,570	44,870
4	Per cent of all improved land in farms.....	55.6	91.3	80.1	47.3	95.7	37.2	33.8	63.5	20.4
5	Timber and cut-over land.....	acres.. 2,195,562	14,072	85,348	16,729	79,740	1,093	7,449	36,550	5,074
6	Other unimproved land.....	acres.. 351,257		10,432	1,013		24,041	63,909	24,277	14,083
7	Swampy or subject to overflow, in enterprises.....	acres.. 1,020,207	6,324	17,893	10,410		225	322	38,350	3,213
8	Suffering a loss of crops from defective drainage.....	acres.. 682,224	8,932	3,051	10,290	1,954		228	25,555	
9	Assessed acreage.....	15,766,478	496,959	149,294	189,913	274,099	135,087	157,271	323,377	78,019
10	Excess over all land in operating enterprises.....	acres.. 6,037,307	184,044	6,660	46,405	32,598	12,210	8,811	70,980	13,992
DRAINAGE WORKS.										
11	Open ditches:									
12	Completed.....	miles.. 16,023.8	465.6	203.2	116.4	425.9	217.7	257.4	245.0	81.0
13	Additional under construction.....	miles.. 118.4	0.9	0.9						2.5
14	Maximum completed in any enterprise.....	miles.. 75.0	10.0	10.1	13.7	11.4	4.4	7.4	14.6	19.1
15	Maximum width at bottom of ditch.....	feet.. 70	40	30	22	60	10	18	18	30
16	Maximum of average depths of outlet ditches.....	feet.. 13.0	9.0	7.0	8.5	11.1	10.0	9.5	10.0	9.0
17	Mean depth of branch ditches.....	feet.. 4.3	4.1	4.0	4.0	4.2	5.5	3.2	5.0	3.0
18	Tile drains:									
19	Completed.....	miles.. 2,173.9	13.2	0.3	44.3	1.1	74.4	100.6	47.4	2.8
20	Additional under construction.....	miles.. 8.4	0.3		0.1					
21	Maximum completed in any enterprise.....	miles.. 10.5	1.3	0.3	10.5	0.7	10.0	4.9	2.5	0.9
22	Maximum size of tile.....	inches.. 48	18	12	24	20	36	28	20	18
23	Accessory levees and dikes:							0.1		
24	Completed.....	miles.. 33.1								
25	Additional under construction.....	miles..								
26	Pumping plants:									
27	Engine capacity.....	horsepower.. 1,065								
28	Pump capacity.....	gallons per minute.. 62,000								
29	Area served by pumps.....	acres.. 10,100								
30	Area drained by open ditches only.....	acres.. 8,541,556	301,173	142,614	119,120	237,501	93,862	90,000	226,105	60,542
31	Length of these ditches.....	miles.. 14,725.0	445.4	202.0	100.5	421.0	193.0	212.3	205.9	77.5
32	Average length per acre.....	feet.. 9.1	7.8	7.5	4.5	9.4	10.9	12.3	4.8	0.8
33	Area having open ditches and levees.....	acres.. 32,000						1,000		
34	Length of these ditches.....	miles.. 33.0						4.6		
35	Average length per acre.....	feet.. 24.3						0.1		
36	Length of accessory levees.....	miles.. 33.1								
37	Area drained by tile only.....	acres.. 318,514	2,281		8,460		15,292	22,055	6,971	320
38	Length of these tile.....	miles.. 1,303.7	5.2		17.4		52.9	08.6	28.9	0.5
39	Average length per acre.....	feet.. 21.6	12.0		10.9		18.3	15.8	21.9	8.3
40	Area drained by open ditches and tile.....	acres.. 867,101	9,461	1,120	15,919	4,000	13,723	33,596	19,321	3,165
41	Length of these drains.....	miles.. 2,202.2	26.4	2.4	42.9	6.0	46.2	72.5	57.6	8.3
42	Average length per acre.....	feet.. 13.4	16.4	11.8	14.2	7.9	17.8	11.4	15.7	13.8
DEVELOPMENT OF LAND.										
43	Improved land in operating enterprises, 1920.....	acres.. 7,182,352	298,843	158,386	116,347	160,748	97,743	77,102	191,570	44,870
44	Improved land prior to drainage.....	acres.. 2,046,013	230,165	147,975	60,524	148,203	61,201	38,830	2,277	36,411
45	Increase since drainage.....	acres.. 5,136,339	62,678	10,411	55,823	12,455	36,462	38,272	180,293	8,459
46	Per cent of increase.....	250.9	26.5	21.7	92.2	8.4	50.5	98.6		23.2
47	Per cent increase is of all improved land in farms, 1920.....	39.7	19.1	14.3	22.7	7.4	13.9	16.8	62.8	3.9
48	Timber and cut-over land, 1920.....	acres.. 2,195,562	14,072	85,348	16,729	79,740	1,093	7,449	36,550	5,074
49	Timber and cut-over land prior to drainage.....	acres.. 6,809,213	70,750	95,759	23,165	91,397	23,120	36,607	185,348	12,743
50	Decrease since drainage.....	acres.. 4,613,651	62,678	10,411	6,430	11,657	22,027	29,158	148,798	7,669
51	Per cent of decrease.....	67.8	81.7	10.9	27.8	12.8	95.3	79.7	80.3	60.2
52	Other unimproved land, 1920.....	acres.. 351,257			10,432	1,013	24,041	63,909	24,277	14,083
53	Other unimproved land prior to drainage.....	acres.. 873,345			59,819	1,811	38,466	73,023	64,772	14,873
54	Decrease since drainage.....	acres.. 522,088			49,387	798	14,425	9,114	40,405	790
55	Per cent of decrease.....	59.8			82.6	44.1	37.5	12.5	62.5	5.3
56	Swampy or subject to overflow, 1920.....	acres.. 1,020,207	6,324	17,893	10,410		225	322	38,350	3,213
57	Swampy or subject to overflow prior to drainage.....	acres.. 4,763,016	65,240	36,400	58,892	9,649	18,542	58,644	84,665	16,737
58	Decrease since drainage.....	acres.. 3,742,809	58,916	18,507	48,482	9,649	18,317	58,222	46,345	13,524
59	Per cent of decrease.....	78.0	90.3	50.8	82.3	100.0	98.8	99.4	54.7	80.8
CAPITAL INVESTED AND COST PER ACRE.										
60	Total capital invested in and required for completion of operating enterprises.....	dollars.. 25,048,980	416,121	475,212	198,350	500,910	315,540	515,941	421,011	158,793
61	Capital invested in these enterprises to Dec. 31, 1919.....	dollars.. 24,683,715	414,481	473,012	197,771	500,910	315,540	515,941	421,011	150,293
62	Additional capital required to complete these enterprises.....	dollars.. 365,265	1,640	2,200	579					8,500
63	Average cost per acre when completed.....	dollars.. 2.57	1.33	3.31	1.38	2.07	2.57	3.48	1.67	2.48
64	Enterprises constructing open ditches only.....	dollars.. 10,041,495	386,987	473,111	121,104	488,210	216,521	230,889	267,842	148,683
65	Average cost per acre when completed.....	dollars.. 2.23	1.28	3.32	1.02	2.06	2.31	2.64	1.18	2.46
66	Enterprises constructing open ditches and levees.....	dollars.. 176,284						7,984		
67	Average cost per acre when completed.....	dollars.. 88.14						7.98		
68	Enterprises constructing tile drains only.....	dollars.. 2,287,056	6,145		29,964		49,855	124,064	41,847	556
69	Average cost per acre when completed.....	dollars.. 7.18	2.69		3.54		3.20	5.40	6.00	1.74
70	Enterprises constructing open ditches and tile drains.....	dollars.. 3,544,145	22,091	2,101	47,282	12,700	49,164	144,010	111,322	9,554
71	Average cost per acre when completed.....	dollars.. 4.09	2.43	1.88	2.97	3.18	3.58	4.20	5.76	3.02
CROPS.										
72	Improved land in enterprises reporting—									
73	Wheat as principal crop on drained land.....	acres.. 2,060,222	5,880					6,252	189,824	
74	Corn as principal crop on drained land.....	acres.. 1,525,685	212,621					70,804	1,746	
75	Sugar beets as principal crop on drained land.....	acres.. 1,140,880			106,348					
76	Peas and beans (dried) as principal crops on drained land.....	acres.. 616,142				28,994				
77	Hay as principal crop on drained land.....	acres.. 456,601	42,828	58,386		131,784				
78	Vegetables as principal crop on drained land.....	acres.. 272,843	27,674		7,783					
79	Potatoes as principal crop on drained land.....	acres.. 119,909								
80	Oats as principal crop on drained land.....	acres.. 10,032	570							
81	Rye as principal crop on drained land.....	acres.. 7,516			2,216			46		
82	Other crops as principal ones on drained land.....	acres.. 351,895	8,977				97,743			
83	Not reporting principal crop on drained land.....	acres.. 11,687	284							44,870

¹ Office estimate; reported figures exceed improved acreage in all farms in the county as determined by the census of agriculture.
² When works under construction have been completed.
³ Additional area reported under "open ditches only."

⁴ The reported figures have been reduced by the same acreage as the improved land, 1920.
⁵ Per cent not shown when more than 1,000.

DRAINAGE—MICHIGAN.

11

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Cheboy- gan.	Chippewa.	Clare.	Clinton.	Eaton.	Genesee.	Gladwin.	Gratiot.	Hills- dale.
LAND AREA.										
1	Approximate land area of the county.....acres..	464,000	1,006,720	372,480	305,440	365,440	419,200	332,160	370,560	382,080
2	All land in operating drainage enterprises.....acres..	22,483	15,424	21,164	272,709	347,032	188,943	124,029	324,069	197,849
3	Improved land.....acres..	13,915	5,508	13,215	187,269	261,989	136,149	124,029	249,338	185,366
4	Per cent of all improved land in farms.....	24.9	5.2	20.1	67.9	99.3	46.7	98.4	99.2	65.5
5	Timber and cut-over land.....acres..	8,568	9,916	7,940	85,440	85,043	52,443	55,847	75,631	6,889
6	Other unimproved land.....acres..						351			5,594
7	Swampy or subject to overflow, in enterprises.....acres..	4,021	6,750	7,640	28,048	41,544	24,061	23,302	28,147	3,956
8	Suffering a loss of crops from defective drainage.....acres..	490		3,854	27,219	41,997	23,461	17,762	17,419	2,392
9	Assessed acreage.....acres..	26,403	15,424	21,164	818,623	949,278	315,400	124,534	709,808	204,390
10	Excess over all land in operating enterprises.....acres..	3,920			545,914	602,246	126,457	505	468,839	6,541
DRAINAGE WORKS.										
11	Open ditches:									
12	Completed.....miles..	29.8	15.7	43.0	546.7	447.5	342.6	224.4	798.5	174.1
13	Additional under construction.....miles..	0.4					0.4			
14	Maximum completed in any enterprise.....miles..	3.7	6.5	4.2	20.5	27.7	14.5	9.7	23.0	7.5
15	Maximum width at bottom of ditch ¹.....feet..	14	18	8	45	30	30	10	60	30
16	Maximum of average depths of outlet ditches ¹.....feet..	5.0	7.0	6.0	11.0	12.0	8.0	6.7	12.1	6.5
17	Mean depth of branch ditches ¹.....feet..		7.0	3.6	3.8	4.9	4.5	4.2	4.8	3.8
18	Tile drains:									
19	Completed.....miles..			3.8	97.1	185.7	106.9	0.9	174.3	173.8
20	Additional under construction.....miles..					2.3				
21	Maximum completed in any enterprise.....miles..			0.9	4.6	7.1	3.5	0.6	4.8	5.5
22	Maximum size of tile ¹.....inches..			12	24	36	24	18	27	24
23	Accessory levees and dikes:									
24	Completed.....miles..									
25	Additional under construction.....miles..									
26	Pumping plants:									
27	Engine capacity.....horsepower..									
28	Pump capacity.....gallons per minute..									
29	Area served by pumps.....acres..									
30	Area drained by open ditches only ¹.....acres..	22,483	15,424	18,607	225,436	294,285	124,607	123,375	309,998	95,304
31	Length of these ditches.....miles..	30.2	15.7	38.4	488.6	372.9	269.2	223.5	735.1	101.6
32	Average length per acre.....feet..	7.1	5.4	10.9	11.4	6.7	11.4	9.6	12.5	5.6
33	Area having open ditches and levees ¹.....acres..									
34	Length of these ditches.....miles..									
35	Average length per acre.....feet..									
36	Length of accessory levees.....miles..									
37	Area drained by tile only ¹.....acres..			919	11,033	14,116	15,420	59	2,830	33,863
38	Length of these tile.....miles..			2.3	40.5	123.0	57.4	0.6	127.3	98.4
39	Average length per acre.....feet..			13.2	19.4	46.0	19.7	53.7	237.5	15.3
40	Area drained by open ditches and tile ¹.....acres..			1,638	36,240	38,631	48,916	595	12,141	68,682
41	Length of these drains.....miles..			6.1	114.7	139.6	123.3	1.2	12.1	147.9
42	Average length per acre.....feet..			19.7	16.7	19.1	13.3	10.6	48.0	11.4
DEVELOPMENT OF LAND.										
43	Improved land in operating enterprises, 1920.....acres..	13,915	5,508	13,215	187,269	261,989	136,149	68,182	249,338	185,366
44	Improved land prior to drainage.....acres..	7,116	1,827	7,520	268	622	39,925	35,982		95,427
45	Increase since drainage.....acres..	6,799	3,681	5,695	187,001	261,367	96,224	32,200	249,338	89,939
46	Per cent of increase ²	95.5	201.5	75.7			241.0	89.5		94.2
47	Per cent increase is of all improved land in farms, 1920.....	12.2	3.5	8.7	67.8	99.0	33.0	44.1	99.2	31.8
48	Timber and cut-over land, 1920.....acres..	8,568	9,916	7,940	85,440	85,043	52,443	55,847	75,631	6,889
49	Timber and cut-over land prior to drainage.....acres..	15,367	13,507	13,644	272,174	340,218	148,432	88,047	324,969	19,371
50	Decrease since drainage.....acres..	6,799	3,681	5,695	186,734	261,175	95,989	32,200	249,338	12,482
51	Per cent of decrease.....	44.2	27.1	41.7	68.6	75.4	64.7	36.6	70.7	64.4
52	Other unimproved land, 1920.....acres..						351			5,594
53	Other unimproved land prior to drainage.....acres..				267	192	586			83,051
54	Decrease since drainage.....acres..				267	192	235			77,457
55	Per cent of decrease.....				100.0	100.0	40.1			93.3
56	Swampy or subject to overflow, 1920.....acres..	4,021	6,750	7,640	28,048	41,544	24,061	23,302	28,147	3,956
57	Swampy or subject to overflow prior to drainage.....acres..	14,095	13,308	11,074	101,387	103,745	101,758	31,766	289,209	82,164
58	Decrease since drainage.....acres..	10,074	6,558	4,334	72,439	62,201	77,697	8,464	261,062	78,208
59	Per cent of decrease.....	71.5	49.3	36.2	71.4	60.0	76.4	26.6	90.3	95.2
CAPITAL INVESTED AND COST PER ACRE.										
60	Total capital invested in and required for completion of operating enterprises.....dollars..	23,994	36,731	66,261	1,026,932	1,065,948	705,917	366,320	1,506,847	587,573
61	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	23,594	36,731	66,261	1,026,932	1,058,638	704,672	366,320	1,506,847	587,573
62	Additional capital required to complete these enterprises.....dollars..	400				7,310	1,245			
63	Average cost per acre when completed.....dollars..	1.07	2.38	3.13	3.77	3.07	3.74	2.95	4.64	2.97
64	Enterprises constructing open ditches only.....dollars..	23,994	36,731	54,626	759,416	604,811	292,735	362,051	1,055,206	197,868
65	Average cost per acre when completed.....dollars..	1.07	2.38	2.94	3.37	2.06	2.35	2.93	3.40	2.08
66	Enterprises constructing open ditches and levees.....dollars..									
67	Average cost per acre when completed.....dollars..									
68	Enterprises constructing tile drains only.....dollars..			3,889	66,380	187,730	148,707	929	243,043	162,785
69	Average cost per acre when completed.....dollars..			4.23	6.02	13.30	9.64	15.75	85.88	4.81
70	Enterprises constructing open ditches and tile drains.....dollars..			7,746	201,136	273,407	264,475	3,340	208,508	226,920
71	Average cost per acre when completed.....dollars..			4.73	5.55	7.08	5.41	5.61	17.17	3.30
CROPS.										
72	Improved land in enterprises reporting—									
73	Wheat as principal crop on drained land.....acres..		2,520		77,122	261,250	123,875			184,469
74	Corn as principal crop on drained land.....acres..				461	618				
75	Sugar beets as principal crop on drained land.....acres..				108,482				244,558	122
76	Peas and beans (dried) as principal crops on drained land.....acres..			13,215			2,880			
77	Hay as principal crop on drained land.....acres..	13,915	2,979			112		68,182	4,600	
78	Vegetables as principal crop on drained land.....acres..									
79	Potatoes as principal crop on drained land.....acres..									
80	Oats as principal crop on drained land.....acres..									
81	Rye as principal crop on drained land.....acres..				84		9,394			
82	Other crops as principal ones on drained land.....acres..				1,120				180	775
83	Not reporting principal crop on drained land.....acres..									

¹ When works under construction have been completed.² Per cent not shown when more than 1,000.

DRAINAGE—MICHIGAN.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Huron.	Ingham.	Ionia.	Iosco.	Isabella.	Jackson.	Kalamazoo.	Kent.	Lapeer.
LAND AREA.										
1	Approximate land area of the county.....acres.	546,560	353,920	370,560	364,800	366,080	452,480	359,680	550,400	426,240
2	All land in operating drainage enterprises.....acres.	430,219	222,114	286,153	31,974	307,024	76,139	79,511	145,370	238,235
3	Improved land.....acres.	357,924	177,028	228,743	14,348	120,061	61,747	61,329	143,084	168,308
4	Per cent of all improved land in farms.....	93.3	74.6	85.8	28.9	94.9	20.9	24.7	40.6	57.7
5	Timber and cut-over land.....acres.	72,295	9,905	43,188	14,731	105,963	4,273	10,653	55	60,636
6	Other unimproved land.....acres.		34,281	14,222	2,895		10,119	7,529	2,281	289
7	Swampy or subject to overflow, in enterprises.....acres.	5,939	33,920	28,618	13,450	63,895	9,437	5,715	1,572	25,258
8	Suffering a loss of crops from defective drainage.....acres.	5,547	33,701	28,618	5,070	22,200	9,381	5,208	139	22,480
9	Assessed acreage.....	709,772	694,839	807,072	43,444	319,071	82,190	107,421	250,897	366,038
10	Excess over all land in operating enterprises.....acres.	279,553	472,725	20,919	11,470	12,047	6,051	27,910	105,027	126,803
DRAINAGE WORKS.										
11	Open ditches:									
12	Completed.....miles.	651.1	322.1	243.4	32.1	289.5	112.6	145.5	206.2	372.2
13	Additional under construction.....miles.	7.4						2.6	1.7	7.1
14	Maximum completed in any enterprise.....miles.	17.6	11.4	13.7	4.4	10.2	5.1	7.5	10.0	10.1
15	Maximum width at bottom of ditch ².....feet.	35	25	30	20	20	8	30	30	40
16	Maximum of average depths of outlet ditches ².....feet.	8.0	10.0	9.0	7.0	7.2	10.0	10.0	9.0	10.0
17	Mean depth of branch ditches ².....feet.	5.1	4.2	4.5	3.0	4.3	4.0	5.4	3.5	4.1
18	Tile drains:									
19	Completed.....miles.		154.6	98.8	0.2	277.3	10.5	4.0	14.1	20.2
20	Additional under construction.....miles.									0.2
21	Maximum completed in any enterprise.....miles.		4.9	6.9	0.2	7.4	0.9	0.8	1.5	1.6
22	Maximum size of tile ².....inches.		48	36	12	27	24	48	36	16
23	Accessory levees and dikes:									
24	Completed.....miles.									
25	Additional under construction.....miles.									
26	Pumping plants:									
27	Engine capacity.....horsepower.									
28	Pump capacity.....gallons per minute.									
29	Area served by pumps.....acres.									
30	Area drained by open ditches only ².....acres.	430,219	160,423	221,038	31,214	135,417	57,371	73,064	128,721	224,100
31	Length of these ditches.....miles.	658.5	243.8	204.4	31.0	137.3	94.9	135.8	180.0	362.2
32	Average length per acre.....feet.	8.1	8.0	4.9	5.2	5.4	8.7	9.8	7.4	8.5
33	Area having open ditches and levees ².....acres.									
34	Length of these ditches.....miles.									
35	Average length per acre.....feet.									
36	Length of accessory levees.....miles.									
37	Area drained by tile only ².....acres.		13,970	32,346		38,218	3,498	320	2,631	3,165
38	Length of these tile.....miles.		66.6	75.7		146.8	5.3	0.2	5.9	12.4
39	Average length per acre.....feet.		36.5	12.4		20.3	8.0	3.3	11.8	20.7
40	Area drained by open ditches and tile ².....acres.		47,721	32,769	760	133,389	15,270	6,127	14,018	10,970
41	Length of these drains.....miles.		136.3	62.1	1.3	282.7	22.9	16.1	36.1	25.1
42	Average length per acre.....feet.		15.1	10.0	9.0	11.2	7.9	13.9	13.6	12.1
DEVELOPMENT OF LAND.										
43	Improved land in operating enterprises, 1920.....acres.	357,924	177,028	228,743	14,348	120,061	61,747	61,329	143,084	168,308
44	Improved land prior to drainage.....acres.		132,017	142,179	9,363	153,351	51,070	25,473	127,696	16,484
45	Increase since drainage.....acres.	357,924	45,911	86,564	4,985	47,710	10,677	35,856	15,488	151,824
46	Per cent of increase.....		34.8	60.9	53.2	31.1	20.9	140.8	12.1	921.0
47	Per cent increase is of all improved land in farms, 1920.....	93.3	10.3	32.5	10.0	22.5	3.0	14.5	4.4	52.0
48	Timber and cut-over land, 1920.....acres.	72,295	9,905	43,188	14,731	105,963	4,273	10,653	55	69,638
49	Timber and cut-over land prior to drainage.....acres.	430,219	27,001	120,752	18,672	153,673	8,029	15,061	55	220,904
50	Decrease since drainage.....acres.	357,924	17,096	80,564	3,941	47,710	3,756	5,008		151,266
51	Per cent of decrease.....	83.2	63.3	66.7	21.1	31.0	46.8	32.0		68.5
52	Other unimproved land, 1920.....acres.		34,281	14,222	2,895		10,119	7,529	2,281	289
53	Other unimproved land prior to drainage.....acres.		33,096	14,222	3,939		17,040	38,377	17,719	847
54	Decrease since drainage.....acres.		28,815		1,044		6,921	30,848	15,488	558
55	Per cent of decrease.....		46.7		26.5		40.6	80.4	87.4	65.9
56	Swampy or subject to overflow, 1920.....acres.	5,939	33,920	28,618	13,450	63,895	9,437	5,715	1,572	25,258
57	Swampy or subject to overflow prior to drainage.....acres.	335,752	60,544	114,196	19,179	126,126	17,077	35,857	20,711	124,366
58	Decrease since drainage.....acres.	329,813	32,615	85,578	5,729	62,231	7,640	30,142	19,139	99,108
59	Per cent of decrease.....	98.2	49.0	74.9	29.9	49.3	44.7	84.1	92.4	79.7
CAPITAL INVESTED AND COST PER ACRE.										
60	Total capital invested in and required for completion of operating enterprises.....dollars.	1,211,974	875,515	539,859	65,428	785,943	115,338	178,098	271,543	573,742
61	Capital invested in these enterprises to Dec. 31, 1919.....dollars.	1,180,924	875,515	539,859	65,428	785,943	115,338	167,351	241,543	566,317
62	Additional capital required to complete these enterprises.....dollars.	31,050						10,747	30,000	7,425
63	Average cost per acre when completed.....dollars.	2.82	3.94	1.89	2.05	2.56	1.51	2.24	1.87	2.41
64	Enterprises constructing open ditches only.....dollars.	1,211,974	322,084	336,700	52,694	163,750	84,201	155,330	204,778	521,372
65	Average cost per acre when completed.....dollars.	2.82	2.01	1.52	1.60	1.21	1.47	2.13	1.50	2.33
66	Enterprises constructing open ditches and levees.....dollars.									
67	Average cost per acre when completed.....dollars.									
68	Enterprises constructing tile drains only.....dollars.		283,644	102,573		197,453	9,447	604	34,947	18,455
69	Average cost per acre when completed.....dollars.		20.30	3.17		5.17	2.70	1.89	13.28	5.83
70	Enterprises constructing open ditches and tile drains.....dollars.		269,787	100,577	12,734	424,740	21,690	22,164	31,818	33,015
71	Average cost per acre when completed.....dollars.		5.65	3.07	16.76	3.18	1.42	3.62	2.27	3.09
CROPS.										
72	Improved land in enterprises reporting—									
73	Wheat as principal crop on drained land.....acres.		10,411	1,440			1,300	539		168,308
74	Corn as principal crop on drained land.....acres.		166,905	227,303			48,418	39,935	138,280	
75	Sugar beets as principal crop on drained land.....acres.	357,924								
76	Peas and beans (dried) as principal crops on drained land.....acres.					200,984				
77	Hay as principal crop on drained land.....acres.		612				9,588	6,567	1,689	
78	Vegetables as principal crop on drained land.....acres.							1,704	1,180	
79	Potatoes as principal crop on drained land.....acres.							140		
80	Oats as principal crop on drained land.....acres.							1,467		
81	Rye as principal crop on drained land.....acres.									
82	Other crops as principal ones on drained land.....acres.							10,887	1,935	
83	Not reporting principal crop on drained land.....acres.									

¹ Office estimate; reported figures exceed improved acreage in all farms in the county as determined by the census of agriculture.² When works under construction have been completed.³ The reported figures have been reduced by the same acreage as the improved land, 1920.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Lena- wee.	Living- ston.	Macomb.	Manis- tee.	Mason.	Mecosta.	Midland.	Missau- kee.	Monroe.	Mont- calm.
LAND AREA.											
1	Approximate land area of the county.....	acres..	475,520	363,520	302,080	359,680	316,160	365,440	338,560	372,480	463,360
2	All land in operating drainage enterprises.....	acres..	275,535	213,481	256,359	12,123	26,333	23,590	326,690	26,802	251,387
3	Improved land.....	acres..	245,775	173,083	1208,052	6,885	18,431	21,503	101,210	10,388	215,029
4	Per cent of all improved land in farms.....		66.4	74.8	93.0	8.1	17.0	13.0	98.1	13.3	79.2
5	Timber and cut-over land.....	acres..	29,760	17,853	48,101	5,243	7,878	2,027	225,480	16,414	32,314
6	Other unimproved land.....	acres..	22,545	206			24				4,044
7	Swampy or subject to overflow, in enterprises.....	acres..	30,199	23,719	21,178	4,047	9,456	4,584	89,842	8,228	23,525
8	Suffering a loss of crops from defective drainage.....	acres..	27,823	42,638	206	2,090	1,367	2,668	156	1,065	32,281
9	Assessed acreage.....		568,882	249,667	303,572	12,123	26,755	31,910	415,628	26,882	604,982
10	Excess over all land in operating enterprises.....	acres..	293,347	36,186	47,213		422	8,320	88,938	60	313,595
DRAINAGE WORKS.											
Open ditches:											
11	Completed.....	miles..	465.6	245.2	348.2	20.8	94.3	41.4	608.1	60.7	627.3
12	Additional under construction.....	miles..	9.3		0.4	4.5			8.7	0.7	1.1
13	Maximum completed in any enterprise.....	miles..	10.9	10.9	10.2	7.6	9.4	4.2	16.4	17.0	18.0
14	Maximum width at bottom of ditch ²	feet..	15	30	30	12	10	8	40	12	25
15	Maximum of average depths of outlet ditches ²	feet..	10.0	9.0	8.0	4.0	5.5	7.8	8.2	5.0	10.0
16	Mean depth of branch ditches ²	feet..	4.2	5.5	3.4	3.0	3.6	3.5	4.5	3.6	
Tile drains:											
17	Completed.....	miles..	233.3	65.2	12.1	0.3	0.4	1.7	58.0	0.2	24.1
18	Additional under construction.....	miles..	1.9		0.8				1.4		
19	Maximum completed in any enterprise.....	miles..	3.2	4.2	4.0	0.2	0.4	1.3	6.9	0.2	2.6
20	Maximum size of tile ²	inches..	32	20	24	15		24	15	15	20
Accessory levees and dikes:											
21	Completed.....	miles..									
22	Additional under construction.....	miles..									
Pumping plants:											
23	Engine capacity.....	horsepower..									
24	Pump capacity.....	gallons per minute..									
25	Area served by pumps.....	acres..									
26	Area drained by open ditches only ²	acres..	198,117	153,527	216,800	11,352	26,292	22,258	286,514	26,205	243,887
27	Length of these ditches.....	miles..	414.8	164.5	338.0	33.8	94.3	39.3	530.8	58.1	622.6
28	Average length per acre.....	feet..	11.1	5.7	8.2	15.7	18.9	9.3	9.8	11.7	13.5
29	Area having open ditches and levees ²	acres..									
30	Length of these ditches.....	miles..									
31	Average length per acre.....	feet..									
32	Length of accessory levees.....	miles..									
33	Area drained by tile only ²	acres..	34,158	6,021	4,611		41	480	0,185		4,890
34	Length of these tile.....	miles..	170.7	10.6	4.2		0.4	1.3	35.9		20.4
35	Average length per acre.....	feet..	28.4	17.2	4.8		51.5	14.3	30.6		22.0
36	Area drained by open ditches and tile ²	acres..	43,260	53,933	34,948	776		852	33,991	597	2,610
37	Length of these drains.....	miles..	124.6	126.3	18.8	0.8		2.5	103.1	4.9	9.5
38	Average length per acre.....	feet..	15.2	12.4	2.8	5.4		15.5	16.0	43.3	19.2
DEVELOPMENT OF LAND.											
39	Improved land in operating enterprises, 1920.....	acres..	245,775	173,083	1208,052	6,885	18,431	21,563	101,210	10,388	215,029
40	Improved land prior to drainage.....	acres..	916	633	800	2,946	5,269	20,138	49,429	4,761	1,910
41	Increase since drainage.....	acres..	244,859	172,450	207,252	3,939	13,162	1,425	51,781	5,627	213,119
42	Per cent of increase ¹					133.7	249.8	7.1	104.8	118.6	
43	Per cent increase is of all improved land in farms, 1920.....		66.2	74.5	93.6	4.6	12.2	0.9	47.6	7.2	78.5
44	Timber and cut-over land, 1920.....	acres..	29,760	17,853	48,101	5,243	7,878	2,027	225,480	16,414	32,314
45	Timber and cut-over land prior to drainage.....	acres..	254,249	134,180	254,993	9,182	21,040	3,452	277,261	22,051	189,383
46	Decrease since drainage.....	acres..	224,489	116,307	206,892	3,939	13,162	1,425	51,781	5,637	157,069
47	Per cent of decrease.....		88.3	86.7	81.1	42.9	62.6	41.3	18.7	25.6	82.9
48	Other unimproved land, 1920.....	acres..		22,545	206		24				4,044
49	Other unimproved land prior to drainage.....	acres..	20,370	78,688	566		24				60,094
50	Decrease since drainage.....	acres..	20,370	56,143	360						56,050
51	Per cent of decrease.....		100.0	71.3	63.6						93.3
52	Swampy or subject to overflow, 1920.....	acres..	30,199	23,719	21,178	4,047	9,456	4,584	89,842	8,228	23,525
53	Swampy or subject to overflow prior to drainage.....	acres..	195,491	59,688	141,109	9,182	14,989	11,384	228,063	18,630	209,472
54	Decrease since drainage.....	acres..	165,292	35,969	119,931	5,135	5,533	6,800	138,221	10,402	185,947
55	Per cent of decrease.....		84.6	60.8	85.0	55.9	36.9	59.7	60.6	55.8	88.8
CAPITAL INVESTED AND COST PER ACRE.											
56	Total capital invested in and required for completion of operating enterprises.....	dollars..	946,798	487,880	396,849	31,010	88,803	54,893	1,029,181	64,498	479,937
57	Capital invested in these enterprises to Dec. 31, 1919.....	dollars..	923,653	487,880	396,849	23,610	88,803	54,893	994,167	61,698	479,737
58	Additional capital required to complete these enterprises.....	dollars..	23,145			8,000			35,014	2,800	200
59	Average cost per acre when completed.....	dollars..	3.44	2.29	1.55	2.61	3.37	2.33	3.15	2.41	1.91
60	Enterprises constructing open ditches only.....	dollars..	482,193	245,113	364,282	20,620	88,515	48,661	830,323	58,976	454,154
61	Average cost per acre when completed.....	dollars..	2.43	1.60	1.68	2.61	3.37	2.19	2.90	2.25	1.86
62	Enterprises constructing open ditches and levees.....	dollars..									
63	Average cost per acre when completed.....	dollars..									
64	Enterprises constructing tile drains only.....	dollars..	261,739	41,476	18,594		288	2,987	37,317		20,434
65	Average cost per acre when completed.....	dollars..	7.66	6.89	4.03		7.02	6.22	6.03		4.18
66	Enterprises constructing open ditches and tile drains.....	dollars..	202,866	201,271	13,973	1,990		3,215	161,541	5,522	5,349
67	Average cost per acre when completed.....	dollars..	4.69	3.73	0.40	2.53		3.77	4.75	9.25	2.05
CROPS.											
68	Improved land in enterprises reporting—										
69	Wheat as principal crop on drained land.....	acres..	107,848	172,256	147,778					169,910	4,792
70	Corn as principal crop on drained land.....	acres..	91,464	827			312	12,448		15,788	28,731
71	Sugar beets as principal crop on drained land.....	acres..	24,535		49,349						1,073
72	Peas and beans (dried) as principal crops on drained land.....	acres..							101,210		21,310
73	Hay as principal crop on drained land.....	acres..				6,885	18,112	9,115		9,765	20,922
74	Vegetables as principal crop on drained land.....	acres..			720					14,210	4,189
75	Potatoes as principal crop on drained land.....	acres..	21,928		10,205		7			15,121	17,014
76	Oats as principal crop on drained land.....	acres..									
77	Rye as principal crop on drained land.....	acres..									
78	Other crops as principal ones on drained land.....	acres..									7,762
	Not reporting principal crop on drained land.....	acres..									5,023

¹ Office estimate; reported figures exceed improved acreage in all farms in the county as determined by the census of agriculture.² When works under construction have been completed.³ Per cent not shown when more than 1,000.

DRAINAGE—MICHIGAN.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Muskegon.	Newaygo.	Oakland.	Oceana.	Osceola.	Ottawa.	Roscom- mon.	Saginaw.	St. Clair.	
LAND AREA.											
1	Approximate land area of the county.....	acres.	322,500	544,640	567,040	347,520	369,280	361,600	344,320	529,920	454,400
2	All land in operating drainage enterprises.....	acres.	85,919	116,695	179,541	84,587	48,829	252,028	8,360	444,570	194,825
3	Improved land.....	acres.	77,417	81,258	132,131	37,116	33,214	215,456	820	1,800,819	142,705
4	Per cent of all improved land in farms.....		71.9	48.5	38.8	24.7	22.5	90.4	7.9	94.8	45.8
5	Timber and cut-over land.....	acres.	8,146	35,437	47,410	47,063	15,615	37,472	2,436	143,751	52,120
6	Other unimproved land.....	acres.	366			408			5,104		
7	Swampy or subject to overflow, in enterprises.....	acres.	4,371	45,072	19,137	9,067	16,912	13,796	3,504	48,229	11,809
8	Suffering a loss of crops from defective drainage.....	acres.	3,806	6,576	244	1,743	7,075	1,516	120	40,241	1,822
9	Assessed acreage.....		88,539	110,095	213,739	85,903	48,829	386,806	8,360	998,319	200,383
10	Excess over all land in operating enterprises.....	acres.	2,670		34,198	1,316		133,878		553,749	95,558
DRAINAGE WORKS.											
11	Open ditches:										
12	Completed.....	miles.	146.8	157.8	249.8	79.5	78.7	388.9	14.4	975.9	410.3
13	Additional under construction.....	miles.	0.7		3.7			0.1	3.2	5.4	3.1
14	Maximum completed in any enterprise.....	miles.	10.6	9.7	16.9	8.1	10.1	8.2	4.5	76.0	8.0
15	Maximum width at bottom of ditch.....	feet.	10	20	25	20	18	30	10	70	40
16	Maximum of average depths of outlet ditches.....	feet.	5.0	8.0	6.0	6.0	5.5	7.0	5.0	10.0	10.0
17	Mean depth of branch ditches.....	feet.	3.0	4.4	5.2	3.8	3.5	4.0	4.0	3.6	3.2
18	Tile drains:										
19	Completed.....	miles.	2.5	6.1	17.4	3.5	0.3	1.5		8.2	
20	Additional under construction.....	miles.			0.5					0.9	0.1
21	Maximum completed in any enterprise.....	miles.	0.7	1.1	1.5	0.7	0.3	0.6		1.4	
22	Maximum size of tile.....	inches.	18	20	30	24	8	24		18	6
23	Accessory levees and dikes:										
24	Completed.....	miles.								33.0	
25	Additional under construction.....	miles.									
26	Pumping plants:										
27	Engine capacity.....	horsepower.								1,060	
28	Pump capacity.....	gallons per minute.								60,000	
29	Area served by pumps.....	acres.								10,000	
30	Area drained by open ditches only.....	acres.	83,946	109,212	147,416	81,923	48,659	250,404	8,360	443,440	192,535
31	Length of these ditches.....	miles.	142.4	140.2	227.3	76.3	78.7	383.0	17.6	890.8	413.0
32	Average length per acre.....	feet.	9.0	7.1	8.1	4.9	8.5	8.1	11.1	10.6	11.2
33	Area having open ditches and levees.....	acres.								1,000	
34	Length of these ditches.....	miles.								89.0	
35	Average length per acre.....	feet.									
36	Length of accessory levees.....	miles.								33.0	
37	Area drained by tile only.....	acres.	80	1,763	13,093	154	170	230		8.55	
38	Length of these tile.....	miles.	0.3	2.9	9.3	1.1	0.3	0.6		8.5	
39	Average length per acre.....	feet.	19.8	8.7	3.8	37.7	9.3	13.8			
40	Area drained by open ditches and tile.....	acres.	1,893	5,720	19,032	2,510		2,294		8.75	940
41	Length of these drains.....	miles.	7.3	14.8	34.8	5.6		6.9		2.1	0.5
42	Average length per acre.....	feet.	20.4	18.7	9.7	11.8		15.9			2.8
DEVELOPMENT OF LAND.											
43	Improved land in operating enterprises, 1920.....	acres.	77,417	81,258	132,131	37,116	33,214	215,456	820	1,800,819	142,705
44	Improved land prior to drainage.....	acres.	73,284	72,916	376	24,029	27,151	100,487			
45	Increase since drainage.....	acres.	4,133	8,342	131,755	12,487	6,063	48,969	820	300,819	142,705
46	Per cent of increase.....		5.0	11.4		50.7	22.3	29.4			
47	Per cent increase is of all improved land in farms, 1920.....		3.8	5.0	38.7	8.3	4.1	20.0	7.9	94.8	45.8
48	Timber and cut-over land, 1920.....	acres.	8,146	35,437	47,410	47,063	15,615	37,472	2,436	143,751	52,120
49	Timber and cut-over land prior to drainage.....	acres.	12,208	43,779	179,165	59,450	21,678	86,441	2,776	443,570	194,825
50	Decrease since drainage.....	acres.	4,062	8,342	131,755	12,387	6,063	48,969	340	299,819	142,705
51	Per cent of decrease.....		33.3	19.1	73.5	20.8	28.0	56.7	12.2	67.6	73.2
52	Other unimproved land, 1920.....	acres.	356			408			5,104		
53	Other unimproved land prior to drainage.....	acres.	427			508			5,584	1,000	
54	Decrease since drainage.....	acres.	71			100			480	1,000	
55	Per cent of decrease.....		16.6			19.7			8.6		
56	Swampy or subject to overflow, 1920.....	acres.	4,371	45,072	19,137	9,067	16,912	13,796	3,504	48,229	11,809
57	Swampy or subject to overflow prior to drainage.....	acres.	22,263	75,246	56,004	20,164	25,366	148,585	8,784	242,367	102,040
58	Decrease since drainage.....	acres.	17,892	30,174	37,527	17,097	8,444	134,789	5,280	194,138	90,231
59	Per cent of decrease.....		80.4	40.1	66.2	55.3	33.3	90.7	60.1	80.1	88.4
CAPITAL INVESTED AND COST PER ACRE.											
60	Total capital invested in and required for completion of operating enterprises.....	dollars.	92,498	155,830	382,647	93,641	84,744	285,763	14,925	1,547,035	408,033
61	Capital invested in these enterprises to Dec. 31, 1919.....	dollars.	90,748	155,830	371,331	93,641	84,744	285,606	11,425	1,525,015	395,198
62	Additional capital required to complete these enterprises.....	dollars.	1,750		11,316			97	3,500	22,020	12,835
63	Average cost per acre when completed.....	dollars.	1.08	1.34	2.13	1.11	1.74	1.13	1.79	3.48	2.09
64	Enterprises constructing open ditches only.....	dollars.	87,185	140,046	269,032	85,022	84,485	281,641	14,925	1,353,465	405,733
65	Average cost per acre when completed.....	dollars.	1.04	1.28	1.82	1.04	1.74	1.12	1.79	3.05	2.10
66	Enterprises constructing open ditches and levees.....	dollars.								168,300	
67	Average cost per acre when completed.....	dollars.									
68	Enterprises constructing tile drains only.....	dollars.	227	4,568	37,403	349	259	290		23,189	
69	Average cost per acre when completed.....	dollars.	2.84	2.59	2.86	2.27	1.52	1.26			
70	Enterprises constructing open ditches and tile drains.....	dollars.	5,086	11,216	76,212	8,270		3,832		2,681	1,309
71	Average cost per acre when completed.....	dollars.	2.69	1.90	4.00	3.29		1.67			1.38
CROPS.											
72	Improved land in enterprises reporting—										
73	Wheat as principal crop on drained land.....	acres.			65,095			29,096		73,713	
74	Corn as principal crop on drained land.....	acres.	955	39,360		2,427		89,592		3,160	139,855
75	Sugar beets as principal crop on drained land.....	acres.					25,094			62,743	385
76	Peas and beans (dried) as principal crops on drained land.....	acres.		2,695			8,120			75,588	
77	Hay as principal crop on drained land.....	acres.	76,462	38,940		34,934			820	55,012	2,465
78	Vegetables as principal crop on drained land.....	acres.			49,305			85,095		29,541	
79	Potatoes as principal crop on drained land.....	acres.			6,018					422	
80	Oats as principal crop on drained land.....	acres.									
81	Rye as principal crop on drained land.....	acres.				18		7,122			
82	Other crops as principal ones on drained land.....	acres.			11,713			3,951		610	
83	Not reporting principal crop on drained land.....	acres.									

¹ Office estimate; reported figures exceed improved acreage in all farms in the county as determined by the census of agriculture.

² When works under construction have been completed.

³ Additional area reported under "open ditches only."

⁴ Per cent not shown when more than 1,000.

DRAINAGE—MICHIGAN.

15

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		St. Joseph.	Sanilac.	Shia- wassee.	Tuscola.	Van Buren.	Wash- tenaw.	Wayne.	Wexford.	Other count- ties. ¹
LAND AREA.										
1	Approximate land area of the county.....acres..	321,920	624,640	356,480	529,280	394,880	450,560	396,800	389,280	2,907,520
2	All land in operating drainage enterprises.....acres..	31,151	540,607	281,106	487,423	173,508	191,590	259,067	10,254	10,967
3	Improved land.....acres..	21,426	² 436,414	199,941	331,924	137,308	104,291	162,850	7,787	7,231
4	Per cent of all improved land in farms.....	9.1	96.1	77.3	98.9	51.6	51.5	76.3	8.8	1.6
5	Timber and cut-over land.....acres..	7,730	103,128	80,925	143,874	4,561	26,615	47,167	734	1,932
6	Other unimproved land.....acres..	1,995	1,065	300	11,025	31,639	690	49,650	1,733	1,804
7	Swampy or subject to overflow, in enterprises.....acres..	3,452	27,752	29,752	18,981	390	16,385	72,546	261	1,991
8	Suffering a loss of crops from defective drainage.....acres..	3,440	27,595	21,176	48,996	45,731	46,243	40,243	367	367
9	Assessed acreage.....	39,977	843,961	584,026	837,194	182,680	208,899	388,322	14,439	11,467
10	Excess over all land in operating enterprises.....acres..	8,826	303,354	302,860	349,771	9,178	77,303	128,655	4,235	500
DRAINAGE WORKS.										
11	Open ditches:									
12	Completed.....miles.....	104.8	1,156.9	501.4	736.0	266.7	267.3	644.8	33.3	39.7
13	Additional under construction.....miles.....	2.1	2.1	42.2	42.2	3.9	10.4	10.4	10.4	13.1
14	Maximum completed in any enterprise.....miles.....	9.8	25.6	14.9	23.2	25.2	10.0	20.5	9.7	13.1
15	Maximum width at bottom of ditch.....feet.....	16	25	40	70	30	30	30	12	14
16	Maximum of average depths of outlet ditches.....feet.....	9.5	8.0	10.0	13.0	10.0	8.0	8.0	3.0	7.0
17	Mean depth of branch ditches.....feet.....	5.2	3.9	3.3	5.1	3.9	4.1	3.0	3.0	6.1
18	Tile drains:									
19	Completed.....miles.....	6.5	0.5	64.1	2.0	10.8	28.8	8.8	0.1	0.5
20	Additional under construction.....miles.....	0.4	0.5	3.5	0.9	1.1	2.7	2.8	0.1	0.3
21	Maximum completed in any enterprise.....miles.....	1.1	0.5	3.5	0.9	1.1	2.7	2.8	0.1	0.3
22	Maximum size of tile.....inches.....	24	12	24	18	24	27	30	10	10
23	Accessory levees and dikes:									
24	Completed.....miles.....	6.5	0.5	64.1	2.0	10.8	28.8	8.8	0.1	0.5
25	Additional under construction.....miles.....	0.4	0.5	3.5	0.9	1.1	2.7	2.8	0.1	0.3
26	Pumping plants:									
27	Engine capacity.....horsepower.....	5	5	5	5	5	5	5	5	5
28	Pump capacity.....gallons per minute.....	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
29	Area served by pumps.....acres.....	100	100	100	100	100	100	100	100	100
30	Area drained by open ditches only.....acres.....	24,831	540,502	249,737	485,853	159,872	168,420	246,347	10,154	10,842
31	Length of these ditches.....miles.....	83.9	1,159.0	441.7	778.2	250.0	253.7	632.5	32.8	39.5
32	Average length per acre.....feet.....	17.8	11.3	9.3	8.5	8.3	8.0	13.6	17.1	19.2
33	Area having open ditches and levees.....acres.....	24,831	540,502	249,737	485,853	159,872	168,420	246,347	10,154	10,842
34	Length of these ditches.....miles.....	83.9	1,159.0	441.7	778.2	250.0	253.7	632.5	32.8	39.5
35	Average length per acre.....feet.....	17.8	11.3	9.3	8.5	8.3	8.0	13.6	17.1	19.2
36	Area drained by tile only.....acres.....	161	105	6,036	1,570	1,969	4,813	1,136	100	100
37	Length of these tile.....miles.....	1.2	0.5	31.0	2.0	4.3	16.8	4.0	0.3	0.3
38	Average length per acre.....feet.....	30.4	25.1	27.1	6.7	11.5	18.4	18.6	15.8	15.8
39	Area drained by open ditches and tile.....acres.....	6,159	25,393	25,393	11,667	18,383	12,184	100	25	25
40	Length of these drains.....miles.....	26.6	92.8	92.8	23.2	29.5	27.5	0.6	0.4	0.4
41	Average length per acre.....feet.....	22.8	19.3	19.3	10.5	8.5	11.9	31.7	84.5	84.5
DEVELOPMENT OF LAND.										
42	Improved land in operating enterprises, 1920.....acres..	21,426	² 436,414	199,941	331,924	137,308	164,291	162,850	7,787	7,231
43	Improved land prior to drainage.....acres..	3,634	1,759	1,759	62,700	552	2,975	1,339	1,502	1,502
44	Increase since drainage.....acres..	17,892	436,414	198,182	331,924	74,608	163,739	159,875	6,448	5,729
45	Per cent of increase.....	506.3	96.1	76.6	98.9	28.0	51.4	74.9	7.3	381.4
46	Per cent increase is of all improved land in farms, 1920.....	7.6	96.1	76.6	98.9	28.0	51.4	74.9	7.3	1.2
47	Timber and cut-over land, 1920.....acres..	7,730	103,128	80,925	143,874	4,561	26,615	47,167	734	1,932
48	Timber and cut-over land prior to drainage.....acres..	25,408	539,340	278,672	476,798	50,098	189,346	135,835	734	5,566
49	Decrease since drainage.....acres..	17,678	436,212	197,747	331,924	45,537	162,731	88,668	3,634	3,634
50	Per cent of decrease.....	69.6	80.9	71.0	69.8	90.9	65.3	65.3	65.3	65.3
51	Other unimproved land, 1920.....acres..	1,995	1,065	300	11,625	31,639	690	49,650	1,733	1,804
52	Other unimproved land prior to drainage.....acres..	2,209	1,267	735	11,625	60,710	1,698	120,867	8,181	3,899
53	Decrease since drainage.....acres..	214	202	435	29,071	1,008	71,207	6,448	2,095	2,095
54	Per cent of decrease.....	9.7	15.9	59.2	47.9	59.4	58.9	78.8	53.7	53.7
55	Swampy or subject to overflow, 1920.....acres..	3,452	27,752	29,752	18,981	390	16,385	72,546	261	1,991
56	Swampy or subject to overflow prior to drainage.....acres..	21,629	400,351	38,739	302,190	28,332	34,068	199,269	8,286	7,775
57	Decrease since drainage.....acres..	18,177	372,599	58,987	283,218	27,942	17,683	126,723	8,025	5,784
58	Per cent of decrease.....	84.0	83.1	60.5	93.7	98.6	51.9	63.6	96.9	74.4
CAPITAL INVESTED AND COST PER ACRE.										
59	Total capital invested in and required for completion of operating enterprises.....dollars.....	149,348	1,374,641	917,107	1,428,968	380,957	394,502	411,151	18,295	45,956
60	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	149,348	1,372,961	917,107	1,301,398	380,957	383,280	408,146	18,295	45,956
61	Additional capital required to complete these enterprises.....dollars..	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680
62	Average cost per acre when completed.....dollars.....	4.79	2.54	3.26	2.93	2.20	2.06	1.58	1.78	4.19
63	Enterprises constructing open ditches only.....dollars.....	128,756	1,373,241	708,764	1,425,277	351,910	307,444	378,957	17,862	45,037
64	Average cost per acre when completed.....dollars.....	5.19	2.54	2.84	2.93	2.20	1.83	1.54	1.76	4.15
65	Enterprises constructing open ditches and levees.....dollars.....	2,273	1,400	67,219	3,686	9,291	33,496	11,229	859	859
66	Average cost per acre when completed.....dollars.....	7.91	13.33	9.48	2.35	4.72	6.96	9.88	8.59	8.59
67	Enterprises constructing open ditches and tile drains.....dollars..	19,319	151,124	151,124	19,756	53,562	20,965	433	60	60
68	Average cost per acre when completed.....dollars.....	3.14	5.05	5.05	1.69	2.92	1.72	4.33	2.40	2.40
CROPS.										
69	Improved land in enterprises reporting—									
70	Wheat as principal crop on drained land.....acres..	6,167	436,142	794	149,241	164,003	108,480	.....	.....	.....
71	Corn as principal crop on drained land.....acres..	7,069	80,258	118,172	.....	288	.....	.....	.....	.....
72	Sugar beets as principal crop on drained land.....acres..	.....	272	.....	.....	.....	.....	.....	.....	.....
73	Pots and beans (dried) as principal crops on drained land.....acres..	.....	.....	.....	.....	.....	.....	.....	7,600	4,831
74	Hay as principal crop on drained land.....acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
75	Vegetables as principal crop on drained land.....acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
76	Potatoes as principal crop on drained land.....acres..	3,329	.....	.....	42,674	5,460	51,210	.....	.....	.....
77	Oats as principal crop on drained land.....acres..	4,341	.....	.....	.....	.....	1,374	.....	.....	.....
78	Rye as principal crop on drained land.....acres..	394	.....	.....	.....	.....	.....	.....	.....	.....
79	Other crops as principal ones on drained land.....acres..	126	.....	.....	21,837	131,848	68	1,718	187	2,400
80	Not reporting principal crop on drained land.....acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....

¹ Includes only Alcona, Alpena, Benzie, Charlevoix, Emmet, Grand Traverse, Lapeer, and Presque Isle Counties.² Office estimate; reported figures exceed improved acreage in all farms in the county as determined by the census of agriculture.³ When works under construction have been completed.⁴ Per cent not shown when more than 1,000.

FOURTEENTH CENSUS OF THE UNITED STATES: 1920

DEPARTMENT
OF COMMERCE

BULLETIN

BUREAU OF
THE CENSUS

DRAINAGE : MINNESOTA

STATISTICS FOR THE STATE AND ITS COUNTIES

Prepared under the supervision of WILLIAM LANE AUSTIN, Chief Statistician for Agriculture, by ROGER D. MARSDEN, Special Agent in Charge of Drainage

CONTENTS.

	Page.		Page.
INTRODUCTION.....	1	DRAINAGE ENTERPRISES—Continued.	
MAP SHOWING OPERATING DRAINAGE ENTERPRISES.....	2	Size of enterprises.....	5
DRAINAGE ON FARMS.....	3	Character of enterprises.....	5
Explanation of terms.....	3	Drainage works.....	6
Farms and farm land.....	3	Maintenance of works.....	7
DRAINAGE ENTERPRISES.....	3	Date of organization.....	7
Explanation of terms.....	3	Crops.....	8
Operating and nonoperating enterprises.....	4	COUNTY TABLES:	
Location of enterprises.....	4	I.—Drainage on farms: 1920.....	8
Condition of land in enterprises.....	4	II.—Operating drainage enterprises: 1920.....	11

INTRODUCTION.

This bulletin presents the statistics of drainage for Minnesota collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises include considerable areas of timbered and other unimproved land not yet

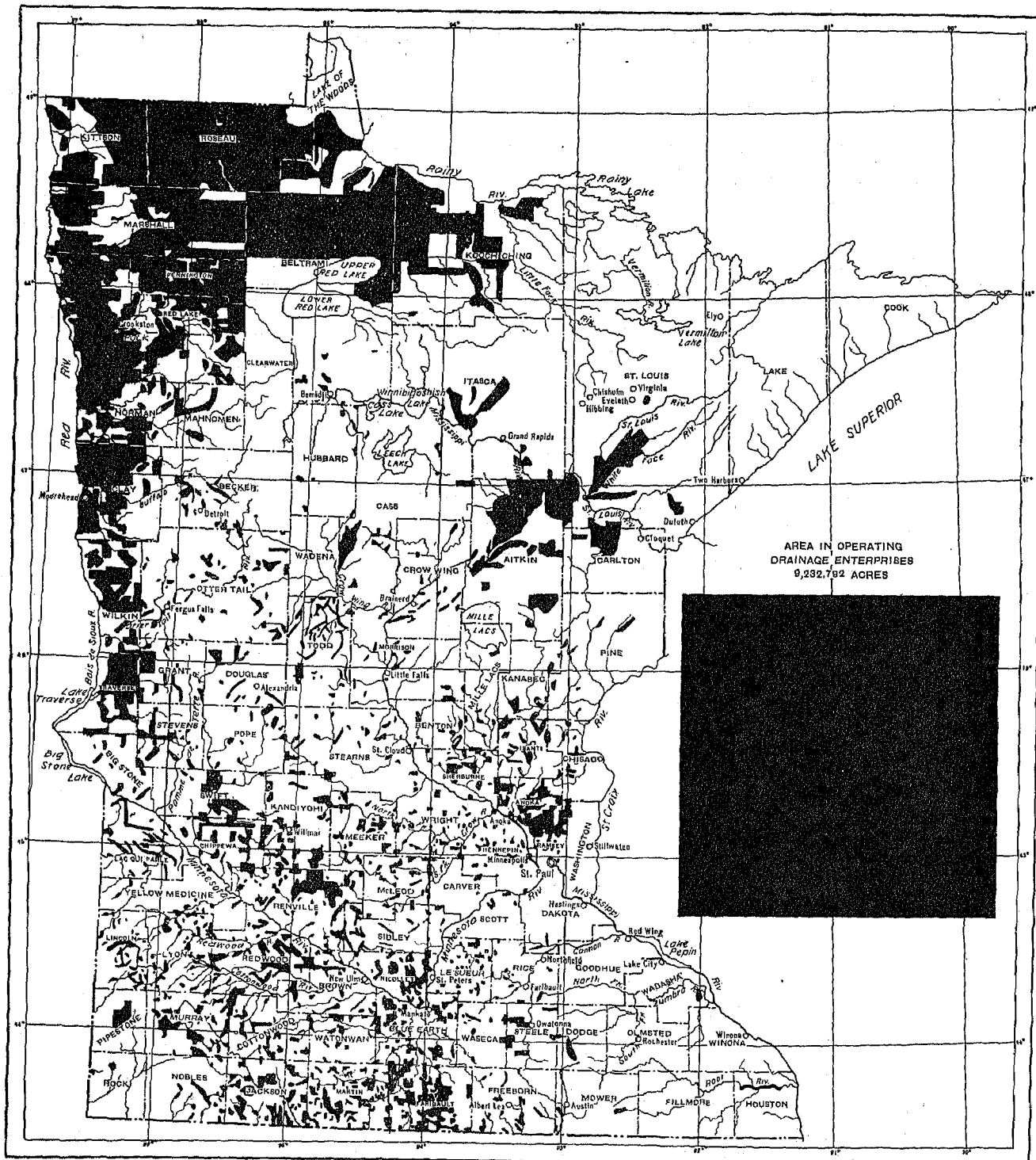
in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
DRAINAGE ON FARMS.		
Number of all farms in the state.....	178,478	100.0
Farms reporting land having drainage.....	53,011	29.7
Farms reporting land needing drainage.....	73,905	41.4
All land in farms.....acres..	30,221,758	100.0
Improved land in farms.....acres..	21,481,710	71.1
Farm land reported as provided with drainage.....acres..	2,993,034	9.9
Farm land reported as needing drainage.....acres..	3,504,574	11.6
DRAINAGE ENTERPRISES.		
Approximate land area of the state.....acres..	51,749,120	100.0
All land in operating drainage enterprises.....acres..	9,232,709	17.8
Improved land.....acres..	3,818,490	7.4
Timber and cut-over land.....acres..	1,370,023	2.6
Other unimproved land.....acres..	4,044,196	7.8
Total capital invested in and required for completion of operating enterprises ..	\$44,183,838	100.0
Capital invested in these enterprises to Dec. 31, 1919.....	\$42,017,447	95.1
Additional capital required to complete these enterprises.....	\$2,166,391	4.9

MINNESOTA

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



DRAINAGE ON FARMS.

Explanation of terms.—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which are substantially as follows:

Drainage of agricultural land was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purpose of improving the condition of the soil and crops.

The area provided with drainage, in farms, is the acreage actually benefited or made of more value for agricultural purposes by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land not now suitable for crops which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators have answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual?" Levee districts, however, generally are not included in the enterprises for which data are given in this bulletin (see definition of drainage enterprises, below).

Farms and farm land.—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for growing crops by reason of the drainage. This is to be distinguished from the area merely provided with outlet facilities by organized drainage enterprises. Drainage on farms represents in most cases the result of work done by the farm owner, either independently or supplemental to the work done by a drainage enterprise, but the acreage would include also any farm land receiving similar benefits directly from the works of an enterprise.

DRAINAGE ENTERPRISES.

Explanation of terms.—The more important terms used in connection with the census of drainage enterprises were defined as follows:

Drainage enterprises comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swamp or overflowed land for sale, other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditches or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise, though the capacities of drainage pumping plants are given only in the counties in which the plants are located.

Operating enterprises, as designated in this bulletin, are those that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

Land in drainage enterprises comprises the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises, deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (a) improved land; (b) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (c) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be considerably greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprises.

Timber and cut-over land includes farm woodland of natural or planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, land subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering loss of crops is intended to include only land devoted to planted crops which suffer damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A pumping district is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

DRAINAGE—MINNESOTA.

Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of reclamation or improvement some years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include enterprises that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also others for which the orders of establishment had just been issued and which were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. ¹			
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.	
			Amount.	Per cent of total.		
All organized enterprises.....	9,362,944	100.0	\$42,089,304	100.0	\$5,095,002	
Operating enterprises.....	9,232,709	98.6	42,017,447	99.8	2,166,391	
Big Sioux River.....	22,937	0.2	455,460	1.1	73,333	
Missouri River.....	24,946	0.3	655,542	1.6	.....
Des Moines River.....	121,097	1.3	3,105,037	7.4	294,219	
Cedar River.....	15,905	0.2	223,549	0.5	52,500	
St. Croix River.....	140,154	1.5	665,007	1.6	.....
Minnesota River.....	815,340	8.7	16,042,816	38.1	1,188,591	
Mississippi River.....	1,020,106	10.9	5,580,657	13.3	128,643	
Red River.....	5,387,462	57.5	11,110,573	26.4	235,906	
Lake of the Woods.....	1,368,366	14.6	2,927,292	7.0	187,200	
Lake Superior.....	310,406	3.4	1,251,514	3.0	6,009	
Nonoperating enterprises.....	130,235	1.4	71,857	0.2	2,928,011	
Big Sioux River.....	999	(¹)	.....	.....	46,475	
Cedar River.....	1,609	(¹)	2,316	(¹)	85,000	
Minnesota River.....	80,211	0.9	62,637	0.1	2,395,988	
Mississippi River.....	3,791	(¹)	4,420	(¹)	163,762	
Red River.....	15,312	0.2	2,484	(¹)	79,700	
Lake Superior.....	28,313	0.3	.....	.....	157,766	

¹ Less than one-tenth of 1 per cent.

Condition of land in enterprises.—Approximately 83 per cent of the drainage enterprises in the state, embracing about 76 per cent of the area of all those enterprises, were reported as organized for the purpose of reclaiming or improving land swampy or generally too wet for profitable cultivation, while practically all the other enterprises were reported as established to prevent overflow of the land by stream floods.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	9,232,709	100.0	8,552,900	679,809	130,235
Improved land.....	3,818,490	41.4	3,701,524	116,966	34,464
Timber and cut-over land....	1,370,023	14.8	1,103,858	266,165	7,158
Other unimproved land.....	4,044,196	43.8	3,747,518	296,678	88,583
Swampy or subject to overflow..	1,193,136	12.9	1,022,667	170,471	78,922
Suffering a loss of crops.....	471,094	5.1	464,471	6,625	981

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflow for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

Location of enterprises.—The drainage enterprises in Minnesota are spread rather generally over the state. The largest enterprises are located in the northwestern part; those in the central and southern sections are greater in number and of smaller average size. There is less land in drainage enterprises in the north central part than in the other sections mentioned, and there is very little in the northeastern part and in the southeastern corner, as shown by the map on page 2.

Nearly three-fourths of the area in the enterprises is drained through Red River and Lake of the Woods, and finally into Hudson Bay, as is shown by Table 3; almost one-fourth is drained through the Mississippi and its tributaries to the Gulf of Mexico; less than 4 per cent is drained, by way of Lake Superior, to St. Lawrence River. For enterprises in the Mississippi drainage basin, however, the capital invested is nearly two-thirds of the total.

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided and the part in each county be considered a separate enterprise. In this way 2,340 operating drainage enterprises are counted in Minnesota, with an average area of 4,263 acres assessed. There are 858 enterprises of less than 500 acres each, and 24 of 50,000 acres or larger.

The assessed acreage exceeds the land in enterprises by 741,953 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed acreage, deduction was made for the amount of overlapping with enterprises organized previously, to determine the acreage to be tabulated as land in enterprises.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	9,232,709	9,974,662	100.0
Less than 200 acres.....	35,877	36,177	0.4
200 to 499 acres.....	188,974	191,761	1.9
500 to 999 acres.....	803,215	807,812	3.1
1,000 to 4,999 acres.....	1,335,447	1,385,737	13.9
5,000 to 9,999 acres.....	1,155,678	1,250,804	12.5
10,000 to 49,999 acres.....	4,150,542	4,630,974	46.4
50,000 to 99,999 acres.....	848,414	944,845	9.5
100,000 to 499,999 acres.....	1,214,562	1,226,562	12.3

Character of enterprises.—Most of the drainage enterprises in Minnesota are county ditches established by orders of the boards of county commissioners, or judicial ditches established by orders of the district courts of the state. The term ditch is defined to include drains of tile and other drainage works. There are also some ditches constructed by or under the control of the state.

County ditches and judicial ditches are generally similar in method of establishment; if proceedings are before the county board the enterprise is a county ditch, and if before the district court the enterprise is a judicial ditch. The county board now has jurisdiction only when the ditch is to benefit land wholly within the county. The district court has concurrent jurisdiction for ditches in one county, and exclusive jurisdiction for ditches in two or more counties within the district. For a ditch in more than one judicial district, proceedings may be in either district.

The law governing county and judicial ditches is the act of April 18, 1905 (ch. 230), as found in chapter 44 of the General Statutes of Minnesota, 1913, and amended to date. A petition for establishment must be filed with the county auditor if for a county ditch, or with the clerk of the district court if for a judicial ditch. It must be signed by eight owners of land to be benefited by the ditch, or by 25 per cent of all the owners of that land, or by the supervisor of any township or the officers of any city or village, or by the authorized agent of any public institution, corporation, or railroad whose land will be benefited, or by the state board of control. Plans and estimates for drainage are made by an engineer appointed by the county board or by the judge of the court, and damages and benefits are assessed by three viewers appointed by the same authority. The order of establishment is issued by the board or the judge after a public hearing upon the petition, the plans, and the assessments, if the enterprise will be of public utility and if the benefits will exceed the cost. Appeals may be taken regarding damages and benefits, to the district court regarding county ditches and to jury trial regarding judicial ditches. The division of the cost among the counties, for a judicial ditch, is made by the judge of the court. Contracts for construction are let by the county auditor, or the county auditors in the case of a judicial ditch, with the chairman of the county board and the clerk of court of the county in which the proceedings are pending. The cost is apportioned in each county by the county auditor according to the benefits confirmed. Bonds for drainage may be issued by the county board, to run not more than 20 years.

The establishment and control of ditches for land drainage by the county commissioners first was authorized in 1883 (ch. 108). A petition for establishment was required from one or more owners of land to be benefited; damages and benefits were assessed by viewers appointed by the commissioners; ditches in two or more counties were established by joint action of the commissioners of those counties. A similar statute of 1887 (ch. 97) contained the additional provision that county bonds might be issued for drainage. A preliminary investigation by an engineer was required before the viewers were appointed, by the drainage law of 1901 (ch. 258), which repealed the earlier laws. Establishment of judicial ditches by the district courts, in case the ditches were to be located in more than one county, was provided by the act of 1905 (ch. 230), which superseded the law of 1901. Judicial ditches wholly within one county were

authorized in 1907 (ch. 448), and this provision continues in the act of 1909 (ch. 469) which repealed that of 1907 and amended that of 1905. Originally, the law of 1905 required 6 signers to the petition. The acts of 1907 and 1909 required only one, but that of 1917 (ch. 441) has increased the number to eight or one-fourth of all affected, except that only two are needed if all the drains will be of tile and will connect with a public ditch.

State ditches now are established in accordance with an act of April 25, 1919 (ch. 471), in much the same manner as judicial ditches. This statute creates a Department of Drainage and Waters, and abolishes the state Drainage Commission created by act of April 26, 1907 (ch. 470), consisting of the governor, the state auditor, and the secretary of state. The method of procedure is very similar to that prescribed by the earlier law. A petition for establishment, accompanied by plans and estimates for the work, is submitted by the commissioner of drainage and waters to the district court of the county in which all or a part of the ditch will be located. Assessments of damages and benefits are made by viewers, two appointed by the court and one by the commissioner. After public hearing, the court may establish the ditch. Construction and maintenance of the works are under control of the Department, the cost being borne by state, private, and other land in proportion to the benefits.

State ditches to be made at state expense were authorized in 1893, when \$100,000 was appropriated for improving watercourses in certain counties in the Red River Valley. The amount was increased by \$50,000 two years later. A board of state drainage commissioners to be appointed by the governor was authorized in 1897, to have control of all state drainage ditches, and to report their condition to the county commissioners who were charged with the maintenance of those ditches within their respective counties. A state Drainage Commission was created in 1901 (ch. 90) with authority to construct ditches.

Town ditches may be established by the town boards of supervisors, under authority of an act of March 29, 1909 (ch. 127), as amended. A petition must be signed by one or more persons or corporations owning land that probably will be benefited. The supervisors view the land and assess damages and benefits, or they appoint an engineer and viewers. Contracts for construction are let by the town board. The costs are advanced by the petitioners, who are reimbursed from tax levies made by the town board according to the benefits.

Drainage and flood control districts may be established under an act of April 23, 1917 (ch. 442), and drainage and conservancy districts under an act of September 22, 1919 (ch. 13, extra session), but no such districts were reported. Each act provides for

establishment of the enterprises as corporate bodies by the district courts, upon petition, and vests the executive authority in a board of three or five directors appointed by the court.

The first drainage law of Minnesota was enacted August 3, 1858 (ch. 73), providing that persons might associate together for draining land and enjoy corporate rights. An act of March 1, 1866 (ch. 27), provided for securing drainage across the land of an objecting owner, by application to a justice of the peace and determination by jury of the necessity for the drain and of benefits and damages to accrue. The establishment of public drains by the town supervisors was authorized by acts of 1887 (ch. 99) and 1889 (ch. 168). A great many other laws have been enacted relating to drainage, but those noted show the character of the enterprises reported.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	9,362,044	100.0	\$42,089,304	100.0	\$5,005,002
Operating enterprises.....	9,232,709	98.6	42,017,447	99.8	2,100,301
County ditches.....	4,384,341	46.8	22,213,139	52.8	700,505
Laws of 1883, ch. 108.....	5,955	0.1	28,183	0.1	.....
Laws of 1887, ch. 97.....	406,900	5.0	744,952	1.8	.....
Laws of 1901, ch. 258.....	679,307	7.3	1,802,226	4.4	.....
Laws of 1905, ch. 230 ¹	3,223,092	34.4	19,201,661	45.8	769,505
Laws of 1907, ch. 448.....	4,532	(²)	154,895	0.4	.....
Laws of 1917, ch. 441.....	4,545	(²)	131,222	0.3	.....
Judicial ditches.....	4,030,424	43.0	18,701,396	44.4	1,300,826
Laws of 1883, ch. 108.....	113,249	1.2	105,385	0.4	.....
Laws of 1887, ch. 97.....	14,916	0.2	24,794	0.1	.....
Laws of 1901, ch. 258.....	148,625	1.6	552,705	1.3	35,329
Laws of 1905, ch. 230.....	3,682,517	39.1	17,460,553	41.5	1,304,497
Laws of 1907, ch. 448.....	91,117	1.0	497,866	1.2	.....
State ditches.....	817,944	8.7	1,102,912	2.6	.....
Laws of 1883, ch. 221.....	30,053	0.3	40,982	0.1	.....
Laws of 1901, ch. 90.....	30,056	0.3	26,237	0.1	.....
Laws of 1907, ch. 470.....	757,835	8.1	1,035,643	2.5	.....
Nonoperating enterprises.....	130,235	1.4	71,857	0.2	2,928,611
County ditches.....	72,599	0.8	53,829	0.1	1,871,504
Laws of 1905, ch. 230 ¹	70,952	0.8	52,472	0.1	1,794,377
Laws of 1917, ch. 441.....	1,014	(²)	1,357	(²)	77,187
Judicial ditches.....	57,669	0.6	18,028	(²)	1,057,047
Laws of 1905, ch. 230.....	57,669	0.6	18,028	(²)	1,057,047

¹ Includes 800 acres under individual ownership.

² Less than one-tenth of 1 per cent.

³ Includes 423 acres organized as a town ditch.

Drainage works.—The total works completed by the drainage enterprises to December 31, 1919, comprised 14,657.0 miles of open ditches, 5,924.6 miles of tile drains, and 0.1 mile of accessory levees; the additional lengths under construction were 166.1 miles of ditches, 462.7 miles of tile drains, and 0.3 mile of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There is no pumping district for land drainage among the enterprises in Minnesota.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	9,232,709	100.0	\$42,017,447	100.0	\$2,166,391
Open ditches only.....	8,440,167	91.4	22,753,563	54.2	485,426
Tile drains only.....	271,118	2.9	7,193,827	17.1	197,721
Open ditches and tile drains.....	321,424	5.6	12,070,057	28.7	1,483,244

¹Includes 4,642 acres constructing also 0.4 mile of levee.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches, which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet and those 10 feet and greater were omitted as it seemed they did not represent so well the average depths of outlet provided for all the farms in those districts; to include these groups, computed as 3 feet and 10 feet, respectively, would show the mean depth for the state 4.8 instead of 4.9 feet.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	9,232,709	100.0
Less than 3 feet.....	373,377	4.0
3.0 to 3.9 feet.....	941,199	10.2
4.0 to 4.9 feet.....	1,234,445	13.4
5.0 to 5.9 feet.....	2,086,744	22.6
6.0 to 6.9 feet.....	1,427,882	15.5
7.0 to 7.9 feet.....	327,146	3.5
8.0 to 8.9 feet.....	57,034	0.6
9.0 to 9.9 feet.....	3,286	(¹)
10 feet and more.....	77,929	0.8
Not reporting branches.....	2,703,657	29.3

¹ Less than one-tenth of 1 per cent.

Maintenance of works.—The county board of each county is required to keep in proper repair and free from obstruction, after original construction has been completed, all public drainage ditches or parts of such ditches located within the county, according to an act

of April 24, 1915 (ch. 300). The cost is to be paid from the funds to the credit of the ditch so repaired, or, in case those funds are not sufficient, by assessments against the land assessed for original construction of the ditch and in proportion to the original assessment of benefits. The cost of maintenance for any state ditch is to be apportioned according to benefits specially assessed by viewers appointed by the county board, against the land benefited by the construction of the ditch and of any lateral or spur ditch. If the cost of the repairs for any ditch exceeds 25 per cent of the cost of original construction, bonds may be issued. It was provided in 1917 (ch. 441) that in all counties where county and judicial ditches have been constructed costing in the aggregate \$50,000 or more, the county board shall appoint a county ditch inspector who shall examine all those ditches at least twice each season and report to the board what repairs or improvements are needed.

The maintenance of county and judicial ditches by the county boards was required by the original act of 1905 (ch. 230). An act of 1909 (ch. 207) provided that the Department of Drainage and Waters might repair or improve state ditches, and might require that any part of the cost should be paid by the county, town, or individuals to be benefited by the work.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	9,232,709	100.0	\$42,017,447	100.0	\$2,166,391
By district forces.....	308,107	3.3	4,154,450	9.9	229,500
By contract.....	678,139	7.3	8,585,995	20.4	496,006
By method not specified.....	4,746	0.1	60,712	0.1	.....
No maintenance provided.....	8,008,874	86.7	28,471,873	67.8	1,430,885
Not reported.....	237,843	2.6	744,417	1.8	10,000

Date of organization.—The progress of development in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the ditches were established by the county boards or district courts, since there may be a period of a year or more between the order of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large enterprise. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of drainage was completed.

DRAINAGE—MINNESOTA.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acres.	Per cent of total.	Acres.	Per cent of total.
All operating enterprises.....	9,232,709	100.0	9,974,662	100.0
1880 to 1889.....	11,620	0.1	11,620	0.1
1890 to 1899.....	319,941	3.5	323,131	3.2
1900 to 1904.....	883,427	9.6	971,117	9.7
1905 to 1909.....	2,370,214	25.7	2,551,205	25.6
1910 to 1914.....	3,867,415	41.9	4,012,370	40.2
1915 to 1919.....	1,765,875	19.1	2,090,412	21.0
Not reported.....	14,211	0.2	14,211	0.1

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$42,017,447	100.0	\$2,166,391
1880 to 1889.....	88,643	0.2	.....
1890 to 1899.....	481,097	1.1	.....
1900 to 1904.....	1,678,222	4.0	.....
1905 to 1909.....	7,526,768	17.9	17,408
1910 to 1914.....	13,421,985	31.9	108,200
1915 to 1919.....	18,747,547	44.6	1,948,218
Not reported.....	79,175	0.2	2,565

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	14,823.1	100.0	6,387.3	100.0	0.4	100.0
1880 to 1889.....	48.9	0.3	.....	.....	.....	.....
1890 to 1899.....	483.1	3.3	15.7	0.2	.....	.....
1900 to 1904.....	1,459.1	9.8	16.0	0.3	.....	.....
1905 to 1909.....	4,382.8	29.6	606.4	9.5	.....	.....
1910 to 1914.....	4,625.5	31.2	1,760.9	27.6	.....	.....
1915 to 1919.....	3,799.1	25.6	3,976.5	62.3	0.4	100.0
Not reported.....	24.6	0.2	11.8	0.2	.....	.....

Crops.—The principal crops grown upon the drained land in the drainage enterprises are wheat, hay, and corn. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

	THE STATE.	Aitkin.	Anoka.	Becker.	Beltrami.	Benton.	Big Stone.	Blue Earth.	Brown.
1 Number of all farms in the state or county.....	178,478	1,945	1,589	2,631	3,065	1,561	1,026	2,954	1,976
2 Farms reporting land having drainage.....	53,011	287	513	589	721	451	101	1,836	884
3 Farms reporting land needing drainage.....	73,905	1,054	576	1,551	1,470	682	316	1,984	1,083
4 Farms in drainage and levee districts.....	16,421	168	205	103	708	37	35	441	868
LAND AND FARM AREA.									
5 Approximate land area of the state or county.....acres..	51,749,120	1,171,200	203,760	863,360	2,446,080	250,200	314,240	487,680	391,680
6 All land in farms.....acres..	30,221,758	231,221	213,990	454,338	459,487	219,888	287,527	440,386	389,113
7 Improved land in farms.....acres..	21,481,710	81,864	121,603	250,946	89,821	126,949	251,902	355,374	290,808
8 Woodland in farms.....acres..	4,482,956	95,445	59,698	140,413	228,348	51,084	5,086	33,001	19,100
9 Other unimproved land in farms.....acres..	4,257,892	73,912	32,689	62,979	141,318	40,955	30,449	52,011	59,205
10 Farm land reported as provided with drainage.....acres..	2,093,034	13,341	22,124	14,100	58,377	17,529	11,723	99,629	38,078
11 Farm land reported as needing drainage.....acres..	3,604,574	77,588	26,332	84,349	156,097	30,701	13,576	69,818	39,385
12 Drainage only.....acres..	1,801,457	14,241	7,241	19,161	17,627	4,072	12,838	59,204	37,308
13 Drainage and clearing.....acres..	1,703,117	63,347	10,091	65,188	138,470	32,629	738	10,614	2,077

DRAINAGE—MINNESOTA.

9

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Carlton.	Carver.	Cass.	Chippewa.	Chisago.	Clay.	Clearwater.	Cottonwood.	Crow Wing.
1	Number of all farms in the county.....	1,917	2,009	1,579	1,624	2,236	1,948	1,253	1,801	1,281
2	Farms reporting land having drainage.....	95	1,283	182	646	692	345	84	1,134	130
3	Farms reporting land needing drainage.....	702	990	603	658	888	560	266	862	776
4	Farms in drainage and levee districts.....	47	157	73	283	176	125	111	224	79
LAND AND FARM AREA.										
6	Approximate land area of the county.....acres..	554,880	240,640	1,346,560	378,240	273,280	667,520	652,160	409,600	676,480
7	All land in farms.....acres..	185,199	218,382	240,733	355,036	243,819	580,717	203,168	380,043	190,100
8	Improved land in farms.....acres..	54,354	138,654	74,537	317,263	125,788	505,336	65,648	344,590	68,435
9	Woodland in farms.....acres..	70,501	41,430	101,143	7,329	83,185	21,366	97,991	6,613	77,312
10	Other unimproved land in farms.....acres..	59,844	38,298	65,053	30,444	34,846	51,015	39,520	25,840	44,353
11	Farm land reported as provided with drainage.....acres..	2,400	28,651	8,091	32,275	15,432	35,220	2,397	84,453	4,622
12	Farm land reported as needing drainage.....acres..	35,673	28,825	50,826	32,120	30,205	21,934	16,418	41,837	59,940
13	Drainage only.....acres..	1,763	12,895	4,886	31,312	7,238	11,862	8,617	40,961	2,785
	Drainage and clearing.....acres..	33,910	15,930	45,940	808	22,967	10,072	7,801	876	57,155

		Dakota.	Dodge.	Douglas.	Fairbault.	Fillmore.	Freeborn.	Goodhue.	Grant.	Hennepin.	Hubbard.
1	Number of all farms in the county.....	2,373	1,636	2,505	2,358	3,177	2,574	3,128	1,317	3,054	1,262
2	Farms reporting land having drainage.....	163	203	1,020	1,867	58	1,626	70	503	1,035	61
3	Farms reporting land needing drainage.....	412	405	1,468	1,458	160	2,059	515	659	1,522	414
4	Farms in drainage and levee districts.....	27	39	222	852	1	202	11	65	158	23
LAND AND FARM AREA.											
6	Approximate land area of the county.....acres..	383,360	281,600	414,720	460,160	555,520	470,400	490,880	353,920	361,600	613,120
7	All land in farms.....acres..	324,708	247,027	372,869	430,461	506,850	413,088	457,795	319,290	271,762	191,996
8	Improved land in farms.....acres..	258,581	209,445	242,629	361,473	376,279	315,445	347,792	284,049	186,755	80,323
9	Woodland in farms.....acres..	36,347	13,404	64,409	18,541	85,324	20,568	49,359	6,542	51,823	79,434
10	Other unimproved land in farms.....acres..	29,780	24,118	65,831	50,442	45,247	77,980	60,644	28,699	33,184	32,239
11	Farm land reported as provided with drainage.....acres..	3,554	10,999	22,290	176,974	3,676	77,597	1,453	16,897	15,640	2,205
12	Farm land reported as needing drainage.....acres..	19,315	13,841	47,839	85,969	4,761	97,435	10,601	16,097	33,003	31,891
13	Drainage only.....acres..	11,573	11,238	18,466	81,188	3,465	80,176	4,638	14,567	8,178	1,633
	Drainage and clearing.....acres..	7,742	2,903	29,373	5,781	1,296	17,259	6,023	1,630	24,825	30,258

		Isanti.	Itasca.	Jackson.	Kanabec.	Kandi-yohi.	Kittson.	Koochi-ching.	Lac qui Parle.	Le Sueur.
1	Number of all farms in the county.....	2,212	1,436	2,218	1,568	2,432	1,409	944	2,008	2,269
2	Farms reporting land having drainage.....	600	71	1,467	355	902	177	143	783	851
3	Farms reporting land needing drainage.....	1,003	733	1,234	444	1,609	427	647	930	1,131
4	Farms in drainage and levee districts.....	242	56	799	132	444	70	104	183	56
LAND AND FARM AREA.										
6	Approximate land area of the county.....acres..	282,880	1,747,200	449,280	341,760	512,640	711,040	2,010,240	505,600	298,240
7	All land in farms.....acres..	256,010	168,976	424,792	182,311	464,941	442,939	152,507	464,784	264,814
8	Improved land in farms.....acres..	138,810	33,637	372,670	67,535	360,306	342,087	22,450	419,986	178,913
9	Woodland in farms.....acres..	70,083	106,916	0,710	80,003	23,707	43,814	93,231	8,794	35,225
10	Other unimproved land in farms.....acres..	47,117	28,423	42,412	34,773	80,928	57,038	36,226	36,004	50,676
11	Farm land reported as provided with drainage.....acres..	12,032	2,468	110,293	9,252	29,730	55,413	4,850	27,897	22,966
12	Farm land reported as needing drainage.....acres..	30,169	62,768	77,482	16,542	67,963	32,400	70,919	27,051	31,637
13	Drainage only.....acres..	10,671	4,000	67,152	2,915	55,612	2,497	1,586	26,717	13,184
	Drainage and clearing.....acres..	19,498	58,768	10,330	13,727	12,351	29,903	69,333	334	18,453

		Lincoln.	Lyon.	McLeod.	Mahmomen.	Marshall.	Martin.	Meeker.	Mille Lacs.	Morrisson.	Mower.
1	Number of all farms in the county.....	1,468	1,816	2,447	590	2,697	2,435	2,460	1,898	3,095	2,364
2	Farms reporting land having drainage.....	567	934	1,538	92	602	2,025	760	357	350	486
3	Farms reporting land needing drainage.....	693	811	1,500	413	877	1,664	1,029	729	820	657
4	Farms in drainage and levee districts.....	77	242	137	13	553	933	79	104	102	16
LAND AND FARM AREA.											
6	Approximate land area of the county.....acres..	342,400	453,120	317,440	366,080	1,144,320	460,160	397,440	373,120	731,520	455,040
7	All land in farms.....acres..	305,315	409,218	290,131	133,499	734,432	437,329	364,660	178,550	440,018	404,092
8	Improved land in farms.....acres..	270,732	358,206	252,606	82,218	523,383	372,380	280,664	79,548	228,139	354,636
9	Woodland in farms.....acres..	4,417	8,452	19,085	23,347	81,036	9,889	28,601	70,223	157,388	16,486
10	Other unimproved land in farms.....acres..	30,166	42,560	27,440	27,934	120,414	55,695	55,695	28,779	74,486	32,970
11	Farm land reported as provided with drainage.....acres..	21,195	64,173	47,434	4,711	109,896	187,232	20,937	10,882	11,409	23,358
12	Farm land reported as needing drainage.....acres..	21,425	46,683	40,726	27,554	89,984	82,842	40,398	33,488	41,545	26,695
13	Drainage only.....acres..	20,847	45,876	29,856	9,316	28,570	73,109	24,973	3,025	7,794	22,187
	Drainage and clearing.....acres..	578	807	10,870	18,238	61,414	4,733	15,425	30,463	33,751	4,508

DRAINAGE—MINNESOTA.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Murray.	Nicollet.	Nobles.	Norman.	Olms- ted.	Otter Tail.	Penn- ington.	Pine.	Pipe- stone.	Polk.
1	Number of all farms in the county.....	1,876	1,497	2,018	1,940	2,287	6,627	1,221	3,088	1,187	4,200
2	Farms reporting land having drainage.....	1,175	718	1,029	591	100	1,028	448	447	104	1,106
3	Farms reporting land needing drainage.....	1,104	896	831	370	392	3,119	351	1,418	199	1,412
4	Farms in drainage and levee districts.....	877	124	208	292	12	415	403	80	49	713
LAND AND FARM AREA.											
5	Approximate land area of the county.....acres..	450,560	283,520	462,080	550,400	426,240	1,304,960	388,480	904,320	300,160	1,266,560
6	All land in farms.....acres..	415,872	267,521	437,608	489,358	376,221	1,095,739	284,888	833,418	276,371	1,069,165
7	Improved land in farms.....acres..	384,616	212,407	402,236	401,179	303,723	683,406	194,473	121,901	248,105	842,208
8	Woodland in farms.....acres..	4,000	21,740	7,951	33,340	39,453	276,118	39,158	93,746	1,887	112,040
9	Other unimproved land in farms.....acres..	27,256	33,374	27,421	54,839	33,045	136,215	51,057	117,771	26,379	114,907
10	Farm land reported as provided with drainage.....acres..	86,583	37,274	70,900	122,092	2,208	44,840	76,909	10,533	7,703	184,731
11	Farm land reported as needing drainage.....acres..	45,397	36,694	41,084	16,958	9,940	119,323	40,804	62,068	8,122	85,350
12	Drainage only.....acres..	43,482	31,291	37,108	6,412	5,700	35,754	20,629	5,412	7,421	33,284
13	Drainage and clearing.....acres..	1,915	5,403	3,946	10,646	4,240	83,569	20,175	56,656	701	52,066

		Pope.	Ramsey.	Red Lake.	Redwood.	Renville.	Rice.	Rock.	Roseau.	St. Louis.
1	Number of all farms in the county.....	1,802	983	907	2,548	3,049	2,416	1,307	1,854	4,271
2	Farms reporting land having drainage.....	452	36	115	1,390	1,463	467	315	500	823
3	Farms reporting land needing drainage.....	819	67	277	1,677	1,016	992	454	537	1,900
4	Farms in drainage and levee districts.....	52	13	102	487	237	94	12	442	190
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	443,520	103,040	276,480	563,840	625,920	316,800	314,880	1,068,800	4,161,920
6	All land in farms.....acres..	381,123	52,498	224,729	525,074	535,156	297,038	292,804	416,294	402,351
7	Improved land in farms.....acres..	288,254	36,195	159,586	449,906	511,771	217,241	267,541	212,214	93,471
8	Woodland in farms.....acres..	16,260	9,761	43,101	10,581	23,912	22,041	5,194	90,517	210,620
9	Other unimproved land in farms.....acres..	76,614	6,542	22,042	64,587	49,473	57,756	20,069	113,563	98,260
10	Farm land reported as provided with drainage.....acres..	10,234	700	19,035	76,069	68,484	10,281	16,151	90,446	17,545
11	Farm land reported as needing drainage.....acres..	22,966	3,591	34,036	79,427	72,501	24,554	20,511	61,262	103,559
12	Drainage only.....acres..	19,359	1,312	10,626	73,946	71,117	14,277	19,061	12,523	10,218
13	Drainage and clearing.....acres..	3,607	2,279	23,410	5,481	1,384	10,277	850	48,739	93,341

		Scott.	Sher- burne.	Sibley.	Stearns.	Steele.	Stevens.	Swift.	Todd.	Trav- erse.
1	Number of all farms in the county.....	1,628	1,400	2,111	4,598	1,860	1,163	1,781	3,521	1,035
2	Farms reporting land having drainage.....	459	294	953	953	956	444	518	715	156
3	Farms reporting land needing drainage.....	710	593	1,208	1,363	1,328	536	832	856	130
4	Farms in drainage and levee districts.....	55	102	301	191	157	129	333	335	116
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	234,240	286,720	374,400	871,680	275,840	360,060	474,240	612,480	363,520
6	All land in farms.....acres..	210,218	224,629	355,809	780,899	259,215	316,003	447,759	474,951	321,002
7	Improved land in farms.....acres..	120,194	127,894	273,705	499,223	213,245	279,283	391,029	243,393	300,530
8	Woodland in farms.....acres..	38,740	56,401	27,870	162,081	12,611	3,419	7,855	136,567	5,120
9	Other unimproved land in farms.....acres..	51,284	40,324	54,234	119,595	33,359	33,306	48,905	95,991	16,352
10	Farm land reported as provided with drainage.....acres..	8,770	10,705	35,410	31,881	35,471	33,286	33,838	22,421	16,843
11	Farm land reported as needing drainage.....acres..	23,108	23,080	49,548	54,017	43,632	24,233	41,039	30,371	7,608
12	Drainage only.....acres..	8,321	5,612	42,733	32,292	35,017	19,533	38,014	7,512	7,283
13	Drainage and clearing.....acres..	14,787	18,468	6,815	22,625	7,715	4,700	3,025	22,859	320

		Wadena.	Waseca.	Wash- ington.	Watson- wan.	Wilkin.	Winona.	Wright.	Yellow Medicine.	All other counties. ¹
1	Number of all farms in the county.....	1,326	1,609	2,014	1,402	1,163	2,150	3,937	2,109	4,158
2	Farms reporting land having drainage.....	318	1,006	155	1,001	178	13	1,406	589	21
3	Farms reporting land needing drainage.....	619	1,179	482	947	64	47	1,622	1,077	480
4	Farms in drainage and levee districts.....	133	123	34	151	167	2	100	155	13
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	344,320	275,840	254,080	277,760	476,800	407,680	442,240	479,360	3,013,120
6	All land in farms.....acres..	206,503	248,191	221,953	250,566	402,139	378,215	403,305	458,050	606,487
7	Improved land in farms.....acres..	102,323	193,270	166,859	225,999	389,687	233,241	260,300	388,729	406,229
8	Woodland in farms.....acres..	60,640	13,543	40,414	4,606	2,671	111,730	71,876	11,924	205,911
9	Other unimproved land in farms.....acres..	34,540	41,378	24,680	28,961	9,781	28,244	71,129	57,397	84,347
10	Farm land reported as provided with drainage.....acres..	14,416	39,312	3,650	83,867	26,199	509	24,007	23,263	493
11	Farm land reported as needing drainage.....acres..	41,749	49,566	13,250	54,838	4,985	1,367	46,776	40,607	13,076
12	Drainage only.....acres..	4,654	37,582	5,504	53,139	4,573	673	14,358	39,655	650
13	Drainage and clearing.....acres..	37,095	11,984	7,746	1,699	412	694	32,418	952	12,426

¹ No drainage on farms reported in Wabasha County.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Aitkin.	Anoka.	Becker.	Beltrami.	Benton.	Big Stone.	Blue Earth.	
LAND AREA.										
1	Approximate land area of the state or county.....	acres.	51,749,120	1,171,200	293,760	863,360	2,446,080	259,200	314,240	487,680
2	All land in operating drainage enterprises.....	acres.	9,232,709	419,680	68,891	17,235	1,211,754	7,979	10,111	54,548
3	Improved land.....	acres.	3,818,490	136,058	26,459	8,412	137,604	4,310	5,918	49,638
4	Per cent of all improved land in farms.....		17.8	58.3	21.8	3.4	41.9	3.4	2.3	14.0
5	Timber and cut-over land.....	acres.	1,370,023	115,255	1,384	200	574,444	316		
6	Other unimproved land.....	acres.	4,044,196	268,367	41,048	8,623	599,706	3,353	4,193	4,910
7	Swampy or subject to overflow, in enterprises.....	acres.	1,193,136	31,557	7,959	6,042	17,818	153	589	
8	Suffering a loss of crops from defective drainage.....	acres.	471,094	25,157	7,839	1,196	35,653		1,371	
9	Assessed acreage.....		9,974,862	419,680	68,891	17,701	1,211,754	7,979	10,111	54,548
10	Excess over all land in operating enterprises.....	acres.	741,953			466				
DRAINAGE WORKS.										
11	Open ditches:									
12	Completed.....	miles.	14,657.0	530.0	303.4	104.8	1,635.5	62.3	34.4	93.0
13	Additional under construction.....	miles.	166.1				32.0	0.7		2.0
14	Maximum completed in any enterprise.....	miles.	216.0	80.0	23.0	27.4	216.0	11.0	8.1	20.0
15	Maximum width at bottom of ditch ²	feet.	72	20	15	12	35	12	8	16
16	Maximum of average depths of outlet ditches ²	feet.	24.0	8.0	8.0	10.0	8.0	5.0	6.0	9.0
17	Mean depth of branch ditches ²	feet.	4.9	5.6	3.5	4.2	5.0	3.3		4.5
18	Tile drains:									
19	Completed.....	miles.	5,924.6		5.7	0.1			42.7	243.0
20	Additional under construction.....	miles.	462.7							6.0
21	Maximum completed in any enterprise.....	miles.	153.0		2.0	0.1			13.5	16.0
22	Maximum size of tile ²	inches.	48		36	36			36	42
23	Accessory levees and dikes:									
24	Completed.....	miles.	0.1							
25	Additional under construction.....	miles.	0.3							
26	Area drained by open ditches only ²	acres.	8,440,167	419,680	63,881	16,545	1,211,754	7,979	5,528	9,847
27	Length of these ditches.....	miles.	13,432.0	530.0	278.6	99.3	1,667.5	63.0	27.4	69.0
28	Average length per acre.....	feet.	8.4	6.7	23.0	31.7	7.3	41.7	26.2	37.0
29	Area drained by tile only ²	acres.	271,118		396				2,902	34,192
30	Length of these tile.....	miles.	2,816.1		2.0				31.6	209.0
31	Average length per acre.....	feet.	54.8		26.7				57.5	32.3
32	Area drained by open ditches and tile ²	acres.	8,711,285		4,614	690			1,681	10,509
33	Length of these drains.....	miles.	4,962.3		28.5	5.6			18.1	69.0
34	Average length per acre.....	feet.	50.2		32.6	42.9			66.9	33.2
DEVELOPMENT OF LAND.										
35	Improved land in operating enterprises, 1920.....	acres.	3,818,490	136,058	26,459	8,412	137,604	4,310	5,918	49,638
36	Improved land prior to drainage.....	acres.	1,722,875	49,079	9,097	2,273		1,134	2,923	3,273
37	Increase since drainage.....	acres.	2,095,615	26,979	17,362	6,139	37,604	3,176	2,995	46,365
38	Per cent of increase ³		121.6	297.2	190.9	270.1		280.1	102.5	
39	Per cent increase is of all improved land in farms, 1920.....		9.8	43.6	14.3	2.4	41.9	2.5	1.2	13.0
40	Timber and cut-over land, 1920.....	acres.	1,370,023	115,255	1,384	200	574,444	316		
41	Timber and cut-over land prior to drainage.....	acres.	1,473,820	117,489	1,656	214	581,444	952		
42	Decrease since drainage.....	acres.	103,797	2,234	272	14	7,000	636		
43	Per cent of decrease.....		7.0	1.9	16.4	6.5	1.2	66.8		
44	Other unimproved land, 1920.....	acres.	4,044,196	268,367	41,048	8,623	599,706	3,353	4,193	4,910
45	Other unimproved land prior to drainage.....	acres.	6,036,014	293,112	58,138	14,748	630,310	5,893	7,188	51,275
46	Decrease since drainage.....	acres.	1,991,818	24,745	17,090	6,125	30,604	2,540	2,995	40,365
47	Per cent of decrease.....		33.0	8.4	29.4	41.5	4.9	43.1	41.7	90
48	Swampy or subject to overflow, 1920.....	acres.	1,193,136	31,557	7,959	6,042	17,818	153	589	
49	Swampy or subject to overflow prior to drainage.....	acres.	4,684,641	168,468	37,123	16,003	154,889	4,116	5,702	43,043
50	Decrease since drainage.....	acres.	3,441,505	136,911	29,169	10,591	137,071	3,963	5,113	43,043
51	Per cent of decrease.....		74.3	81.3	78.6	63.6	88.5	96.3	89.7	100.0
CAPITAL INVESTED AND COST PER ACRE.										
52	Total capital invested in and required for completion of operating enterprises.....	dollars.	44,183,838	966,046	315,585	162,025	3,106,371	64,753	204,470	964,858
53	Capital invested in these enterprises to Dec. 31, 1919.....	dollars.	42,017,447	966,046	315,585	162,025	2,994,371	63,127	204,470	953,768
54	Additional capital required to complete these enterprises.....	dollars.	2,166,391				112,000	1,626		11,090
55	Average cost per acre when completed.....	dollars.	4.79	2.30	4.58	9.40	2.56	8.12	20.22	17.69
56	Enterprises constructing open ditches only.....	dollars.	23,238,989	966,046	231,807	154,334	3,106,371	64,753	86,325	55,766
57	Average cost per acre when completed.....	dollars.	2.75	2.30	8.63	9.33	2.56	8.12	15.62	5.66
58	Enterprises constructing tile drains only.....	dollars.	7,391,548		8,837				62,855	657,744
59	Average cost per acre when completed.....	dollars.	27.26		22.32				21.67	19.24
60	Enterprises constructing open ditches and tile drains.....	dollars.	31,553,301		75,141	7,691			55,260	251,348
61	Average cost per acre when completed.....	dollars.	25.99		16.29	11.15			32.87	23.92
CROPS.										
62	Improved land in enterprises reporting—									
63	Wheat as principal crop on drained land.....	acres.	1,774,205		215	5,435			5,918	
64	Hay as principal crop on drained land.....	acres.	940,935	36,058	24,654	2,977	37,604	3,910		7,894
65	Corn as principal crop on drained land.....	acres.	927,801		1,046			400		41,864
66	Oats as principal crop on drained land.....	acres.	168,239		245					
67	Potatoes as principal crop on drained land.....	acres.	5,939		299					
68	Flax as principal crop on drained land.....	acres.	2,184							
69	Not reporting principal crop on drained land.....	acres.	1,187							

¹ Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.

² When works under construction have been completed.

³ Includes 4,642 acres constructing also 0.4 mile of levee.

⁴ The reported figures have been reduced in proportion to the reduction made in improved land, 1920.

⁵ Per cent not shown when more than 1,000.

⁶ Includes cost of 0.4 mile of levee.

⁷ Includes 4,392 acres reporting barley as principal crop.

⁸ Includes 499 acres reporting sugar beets as principal crop.

DRAINAGE—MINNESOTA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Brown.	Carlton.	Carver.	Cass.	Chippewa.	Chisago.	Clay.	Cotton- wood.	Crow Wing.	
LAND AREA.											
1	Approximate land area of the county.....	acres..	391,680	554,880	240,040	1,346,560	378,240	273,280	667,520	409,800	676,480
2	All land in operating drainage enterprises.....	acres..	27,588	42,500	6,282	71,871	50,782	17,368	379,975	33,524	24,402
3	Improved land.....	acres..	35,310	6,326	3,140	14,137	39,329	8,782	248,830	26,121	12,551
4	Per cent of all improved land in farms.....		5.3	11.5	2.3	19.0	12.4	7.0	49.2	7.6	18.3
5	Timber and cut-over land.....	acres..	33	5,381	99	23,900	3,054	4,092	.....	.....	2,789
6	Other unimproved land.....	acres..	12,195	30,793	3,043	33,834	11,453	6,532	127,053	7,403	9,062
7	Swampy or subject to overflow, in enterprises.....	acres..	3,961	9,520	1,637	.....	1,672	1,238	76,878	3,892	328
8	Suffering a loss of crops from defective drainage.....	acres..	7,394	.....	281	.....	2,507	1,187	14,275	525	.....
9	Assessed acreage.....	acres..	27,588	42,500	6,282	71,871	50,782	17,368	379,975	33,524	24,402
10	Excess over all land in operating enterprises.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
DRAINAGE WORKS.											
11	Open ditches:										
12	Completed.....	miles..	187.9	54.0	52.8	166.0	175.6	74.5	244.5	11.0	105.1
13	Additional under construction.....	miles..	.....	.....	2.3	.....	.....	.....	.....	.....	.....
14	Maximum completed in any enterprise.....	miles..	10.7	37.0	11.6	30.0	42.6	8.0	21.6	5.0	20.0
15	Maximum width at bottom of ditch.....	feet..	12	20	20	12	20	10	20	8	12
16	Maximum of average depths of outlet ditches.....	feet..	10.0	8.0	5.0	7.0	10.0	8.0	8.5	8.6	7.0
17	Mean depth of branch ditches.....	feet..	4.3	5.8	3.1	5.0	3.1	4.0	4.1	4.9	3.6
18	Tile drains:										
19	Completed.....	miles..	184.5	.....	8.7	.....	149.7	.....	1.0	319.4	.....
20	Additional under construction.....	miles..	43.8	.....	1.7	.....	.....	.....	.....	28.6	.....
21	Maximum completed in any enterprise.....	miles..	42.7	.....	3.7	.....	50.4	.....	1.0	33.8	.....
22	Maximum size of tile.....	inches..	36	.....	24	.....	30	.....	18	48	.....
23	Accessory levees and dikes:										
24	Completed.....	miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	Additional under construction.....	miles..	0.3	.....	.....	.....	.....	.....	.....	.....	.....
26	Area drained by open ditches only.....	acres..	9,894	42,500	5,242	71,871	12,365	17,368	376,020	1,093	24,402
27	Length of these ditches.....	miles..	98.6	54.0	47.3	166.0	90.2	74.5	236.7	5.0	105.0
28	Average length per acre.....	feet..	52.6	6.7	47.6	12.2	38.5	22.6	3.3	24.2	22.7
29	Area drained by tile only.....	acres..	6,336	.....	166	.....	23,527	.....	.....	15,078	.....
30	Length of these tile.....	miles..	113.2	.....	3.1	.....	113.9	.....	.....	191.8	.....
31	Average length per acre.....	feet..	94.3	.....	104.9	.....	25.6	.....	.....	67.2	.....
32	Area drained by open ditches and tile.....	acres..	11,308	.....	884	.....	14,890	.....	3,955	17,353	.....
33	Length of these drains.....	miles..	154.4	.....	15.1	.....	121.2	.....	8.8	162.2	.....
34	Average length per acre.....	feet..	72.1	.....	90.2	.....	43.0	.....	11.7	49.4	.....
DEVELOPMENT OF LAND.											
35	Improved land in operating enterprises, 1920.....	acres..	15,310	6,326	3,140	14,137	39,329	8,782	248,830	26,121	12,551
36	Improved land prior to drainage.....	acres..	8,910	3,949	614	.....	23,576	2,509	121,358	10,114	4,059
37	Increase since drainage.....	acres..	6,400	2,377	2,526	14,137	15,753	6,213	127,472	16,007	8,492
38	Per cent of increase.....		71.8	60.2	411.4	.....	66.8	241.8	105.0	158.3	209.2
39	Per cent increase is of all improved land in farms, 1920.....		2.2	4.3	1.8	19.0	5.0	4.9	25.2	4.6	12.4
40	Timber and cut-over land, 1920.....	acres..	33	5,381	99	23,900	.....	3,054	4,092	.....	2,789
41	Timber and cut-over land prior to drainage.....	acres..	33	6,633	170	24,572	.....	3,054	4,508	.....	4,255
42	Decrease since drainage.....	acres..	.....	252	71	672	.....	.....	416	.....	1,466
43	Per cent of decrease.....		.....	4.5	41.8	2.7	.....	.....	9.2	.....	34.5
44	Other unimproved land, 1920.....	acres..	12,195	30,793	3,043	33,834	11,453	5,532	127,053	7,403	9,062
45	Other unimproved land prior to drainage.....	acres..	18,595	32,918	5,498	47,209	27,206	11,745	254,109	23,410	16,088
46	Decrease since drainage.....	acres..	6,400	2,125	2,455	13,465	15,753	6,213	127,056	16,007	7,025
47	Per cent of decrease.....		34.4	6.5	44.7	28.5	57.9	52.0	50.0	68.4	43.7
48	Swampy or subject to overflow, 1920.....	acres..	3,961	9,520	1,637	.....	1,672	1,238	76,878	3,892	328
49	Swampy or subject to overflow prior to drainage.....	acres..	10,556	20,568	6,253	63,317	16,571	8,906	168,989	13,299	11,246
50	Decrease since drainage.....	acres..	6,594	17,048	4,616	63,317	14,899	7,668	92,111	9,407	10,918
51	Per cent of decrease.....		62.5	64.2	73.8	100.0	89.0	86.1	54.5	70.7	97.1
CAPITAL INVESTED AND COST PER ACRE.											
52	Total capital invested in and required for completion of operating enterprises.....	dollars..	692,574	135,012	136,079	268,696	1,036,955	94,962	712,787	952,231	93,973
53	Capital invested in these enterprises to Dec. 31, 1919.....	dollars..	560,185	135,012	117,570	268,696	1,036,955	94,962	712,787	844,301	93,973
54	Additional capital required to complete these enterprises.....	dollars..	132,379	.....	18,500	.....	.....	.....	.....	107,430	.....
55	Average cost per acre when completed.....	dollars..	25.15	3.18	21.66	3.74	20.42	5.47	1.88	28.40	3.85
56	Enterprises constructing open ditches only.....	dollars..	111,204	135,012	85,337	268,696	83,635	94,962	608,212	16,329	93,973
57	Average cost per acre when completed.....	dollars..	11.24	3.18	16.28	3.74	6.76	5.47	1.86	14.94	3.85
58	Enterprises constructing tile drains only.....	dollars..	236,319	.....	16,831	.....	510,630	.....	.....	395,732	.....
59	Average cost per acre when completed.....	dollars..	37.30	.....	107.89	.....	21.70	.....	.....	26.25	.....
60	Enterprises constructing open ditches and tile drains.....	dollars..	345,051	.....	33,911	.....	442,690	.....	14,575	540,170	.....
61	Average cost per acre when completed.....	dollars..	30.51	.....	38.36	.....	20.73	.....	3.69	31.13	.....
CROPS.											
62	Improved land in enterprises reporting--										
63	Wheat as principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
64	Hay as principal crop on drained land.....	acres..	297	6,326	423	14,137	39,329	8,782	29,067	99,548	8,369
65	Corn as principal crop on drained land.....	acres..	15,013	.....	2,717	.....	.....	.....	.....	26,121	4,152
66	Oats as principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	.....	120,215	.....	.....
67	Potatoes as principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
68	Flax as principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
69	Not reporting principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....

¹ When works under construction have been completed.

DRAINAGE—MINNESOTA.

13

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Dodge.	Douglas.	Faribault.	Freeborn.	Grant.	Henne- pin.	Hubbard.	Isanti.	Itasca.	
LAND AREA.											
1	Approximate land area of the county.....	acres..	281,600	414,720	460,160	470,400	353,920	361,000	618,120	282,880	1,747,200
2	All land in operating drainage enterprises.....	acres..	13,902	30,677	118,685	10,084	60,365	13,375	14,302	19,168	99,527
3	Improved land.....	acres..	7,028	16,762	101,504	11,403	60,365	8,030	3,305	9,615	99,527
4	Per cent of all improved land in farms.....	.....	3.4	6.9	28.1	3.6	21.3	4.3	4.1	6.9	.....
5	Timber and cut-over land.....	acres..	.....	.....	236	.....	1,292	5,173	4,937	34,051	.....
6	Other unimproved land.....	acres..	6,874	13,925	17,181	7,445	.....	4,053	5,824	4,616	65,476
7	Swampy or subject to overflow, in enterprises.....	acres..	.....	.....	15,959	4,914	.....	2,629	3,560	1,031	.....
8	Suffering a loss of crops from defective drainage.....	acres..	.....	.....	7,166	511	.....	2,532	.....	.....	.....
9	Assessed acreage.....	acres..	13,902	30,677	118,685	10,084	60,365	13,375	14,302	19,168	99,527
10	Excess over all land in operating enterprises.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
DRAINAGE WORKS.											
11	Open ditches:										
12	Completed.....	miles..	37.0	132.6	129.5	95.4	62.6	94.9	31.0	111.5	97.0
13	Additional under construction.....	miles..	.....	.....	.....	.....	.....	1.3	.....	.....	.....
14	Maximum completed in any enterprise.....	miles..	33.0	28.9	27.9	12.0	10.6	7.8	7.0	11.0	36.0
15	Maximum width at bottom of ditch.....	feet..	10	16	4	25	18	30	16	16	8
16	Maximum of average depths of outlet ditches.....	feet..	5.0	14.0	9.7	12.0	9.0	5.0	5.0	9.0	8.0
17	Mean depth of branch ditches.....	feet..	4.0	3.8	7.5	6.0	4.4	3.4	3.4	4.7	5.8
18	Tile drains:										
19	Completed.....	miles..	10.0	11.5	616.0	17.9	53.5	0.4	.....	.....	.....
20	Additional under construction.....	miles..	.....	.....	23.8	11.3	.....	0.2	.....	.....	.....
21	Maximum completed in any enterprise.....	miles..	10.0	11.1	49.1	10.1	16.2	0.2	.....	.....	.....
22	Maximum size of tile.....	inches..	36	24	36	34	32	24	.....	.....	.....
23	Accessory levees and dikes:										
24	Completed.....	miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	Additional under construction.....	miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	Area drained by open ditches only.....	acres..	770	20,371	14,330	14,209	50,079	13,097	14,302	19,168	99,527
27	Length of these ditches.....	miles..	4.0	122.2	32.3	74.6	56.2	89.9	31.0	111.5	97.0
28	Average length per acre.....	feet..	27.4	22.0	11.9	27.7	5.9	36.2	11.4	30.7	5.1
29	Area drained by tile only.....	acres..	.....	.....	36,646	.....	9,819	.....	.....	.....	.....
30	Length of these tile.....	miles..	.....	.....	244.3	.....	52.7	.....	.....	.....	.....
31	Average length per acre.....	feet..	.....	.....	35.2	.....	28.3	.....	.....	.....	.....
32	Area drained by open ditches and tile.....	acres..	13,132	1,306	67,700	4,875	407	278	.....	.....	.....
33	Length of these drains.....	miles..	43.0	21.9	492.7	50.0	7.2	6.9	.....	.....	.....
34	Average length per acre.....	feet..	17.3	88.5	38.4	54.2	81.4	131.1	.....	.....	.....
DEVELOPMENT OF LAND.											
35	Improved land in operating enterprises, 1920.....	acres..	7,028	16,762	101,504	11,403	60,365	8,030	3,305	9,615	.....
36	Improved land prior to drainage.....	acres..	1,970	10,771	63,042	3,232	45,869	0,096	.....	3,330	.....
37	Increase since drainage.....	acres..	5,058	5,981	38,462	8,171	14,496	1,034	3,305	6,285	.....
38	Per cent of increase.....	.....	250.8	55.5	61.0	252.8	31.6	31.7	.....	188.7	.....
39	Per cent increase is of all improved land in farms, 1920.....	.....	2.4	2.5	10.6	2.6	5.1	1.0	4.1	4.5	.....
40	Timber and cut-over land, 1920.....	acres..	.....	.....	.....	236	.....	1,292	5,173	4,937	34,051
41	Timber and cut-over land prior to drainage.....	acres..	.....	.....	.....	358	.....	1,623	6,897	6,270	34,051
42	Decrease since drainage.....	acres..	.....	.....	.....	122	.....	331	1,724	1,333	.....
43	Per cent of decrease.....	.....	.....	.....	.....	34.1	.....	20.4	25.0	21.3	.....
44	Other unimproved land, 1920.....	acres..	6,874	13,925	17,181	7,445	.....	4,053	5,824	4,616	65,476
45	Other unimproved land prior to drainage.....	acres..	11,932	19,906	55,643	15,494	14,496	5,656	7,405	9,568	65,476
46	Decrease since drainage.....	acres..	5,058	6,981	38,462	8,049	14,496	1,603	1,581	4,952	.....
47	Per cent of decrease.....	.....	42.4	30.0	60.1	61.0	100.0	28.3	21.4	51.8	.....
48	Swampy or subject to overflow, 1920.....	acres..	.....	.....	15,959	4,914	.....	2,629	3,560	1,031	.....
49	Swampy or subject to overflow prior to drainage.....	acres..	6,409	10,509	47,111	18,954	.....	4,636	14,302	9,749	99,527
50	Decrease since drainage.....	acres..	6,409	10,509	31,152	14,040	.....	2,007	10,742	8,715	99,527
51	Per cent of decrease.....	.....	100.0	100.0	66.1	74.1	.....	43.3	75.1	89.4	100.0
CAPITAL INVESTED AND COST PER ACRE.											
52	Total capital invested in and required for completion of operating enterprises.....	dollars..	55,960	197,536	2,317,116	313,283	584,823	237,777	30,887	194,885	241,490
53	Capital invested in these enterprises to Dec. 31, 1919.....	dollars..	55,960	197,536	2,191,616	265,283	584,823	227,277	30,887	194,885	241,490
54	Additional capital required to complete these enterprises.....	dollars..	.....	.....	125,500	48,000	.....	10,500	.....	.....	.....
55	Average cost per acre when completed.....	dollars..	4.03	6.44	10.52	16.42	9.69	17.78	2.16	10.17	2.43
56	Enterprises constructing open ditches only.....	dollars..	8,500	158,132	88,823	155,015	112,506	214,787	30,887	194,885	241,490
57	Average cost per acre when completed.....	dollars..	11.04	5.38	6.19	10.97	2.25	16.40	2.16	10.17	2.43
58	Enterprises constructing tile drains only.....	dollars..	.....	.....	642,854	.....	464,166	.....	.....	.....	.....
59	Average cost per acre when completed.....	dollars..	.....	.....	17.54	.....	47.27	.....	.....	.....	.....
60	Enterprises constructing open ditches and tile drains.....	dollars..	47,460	39,404	1,585,430	157,368	8,151	22,990	.....	.....	.....
61	Average cost per acre when completed.....	dollars..	3.61	30.17	23.42	32.28	17.45	82.70	.....	.....	.....
CROPS.											
62	Improved land in enterprises reporting--										
63	Wheat as principal crop on drained land.....	acres..	7,028	16,762	1,823	340	60,365	404	3,305	9,070	.....
64	Rye as principal crop on drained land.....	acres..	.....	.....	96,905	11,063	.....	322	.....	.....	.....
65	Corn as principal crop on drained land.....	acres..	.....	.....	2,776	.....	.....	7,280	.....	.....	.....
66	Oats as principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	24	.....	545	.....
67	Potatoes as principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
68	Flax as principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
69	Not reporting principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....

* When works under construction have been completed.

DRAINAGE—MINNESOTA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Jackson.	Kanabec.	Kandi- yohi.	Kittson.	Koochi- ching.	Lac qui Parle.	Le Sueur.	Lincoln.	Lyon.	
LAND AREA.											
1	Approximate land area of the county.....	acres..	440,280	341,760	512,640	711,040	2,010,240	505,600	208,240	342,400	453,120
2	All land in operating drainage enterprises.....	acres..	65,147	16,530	66,279	498,294	707,496	26,567	16,721	14,490	31,765
3	Improved land.....	acres..	56,193	8,303	60,023	275,330	14,146	20,109	10,711	11,128	22,507
4	Per cent of all improved land in farms.....	.....	15.1	12.3	16.7	80.5	83.0	4.8	6.0	4.1	6.3
5	Timber and cut-over land.....	acres..	2,713	5,523	27,756	176,875	6,458	6,010	3,362	9,258	5,590
6	Other unimproved land.....	acres..	8,954	5,523	6,256	195,208	516,475	6,458	6,010	3,362	9,258
7	Swampy or subject to overflow, in enterprises.....	acres..	7,897	785	889	12,773	399,119	899	2,336	2,405	5,590
8	Suffering a loss of crops from defective drainage.....	acres..	3,895	386	386	14,740	1,496	0,987	493	925	925
9	Assessed acreage.....	acres..	65,147	16,530	66,279	498,294	707,496	26,567	17,492	14,490	31,765
10	Excess over all land in operating enterprises.....	acres..						771			
DRAINAGE WORKS.											
11	Open ditches:										
12	Completed.....	miles..	70.4	76.0	320.4	395.0	542.0	226.0	108.8	132.2	54.5
13	Additional under construction.....	miles..			3.5		25.0				1.3
14	Maximum completed in any enterprise.....	miles..	18.0	18.0	52.0	43.6	80.0	46.4	13.5	17.0	8.0
15	Maximum width at bottom of ditch ²	feet..	8	16	14	6	20	18	30	20	12
16	Maximum of average depths of outlet ditches ²	feet..	9.8	7.0	12.9	10.0	7.0	12.0	9.8	8.5	8.7
17	Mean depth of branch ditches ²	feet..	5.3	4.1	4.4	4.5	5.2	3.4	5.1	4.4	5.5
18	Tile drains:										
19	Completed.....	miles..	652.1		70.3		111.4	0.2	62.9	303.1	
20	Additional under construction.....	miles..	17.3		12.7				22.1	42.3	
21	Maximum completed in any enterprise.....	miles..	56.8		21.0		17.0	0.2	12.7	19.8	
22	Maximum size of tile ²	inches..	36		24		36	16	30	30	
23	Accessory levees and dikes:										
24	Completed.....	miles..									0.1
25	Additional under construction.....	miles..									
26	Area drained by open ditches only ²	acres..		16,530	52,602	408,204	707,496	12,553	16,430	2,489	5,538
27	Length of these ditches.....	miles..		76.0	276.6	395.0	567.0	120.3	167.5	38.9	30.7
28	Average length per acre.....	feet..		24.3	27.8	4.2	4.2	50.6	58.8	82.5	35.0
29	Area drained by tile only ²	acres..	17,920		1,958		3,086		1,081	16,176	
30	Length of these tile.....	miles..	236.7		32.2		50.9		23.3	251.1	
31	Average length per acre.....	feet..	69.7		86.8		102.5		113.8	82.0	
32	Area drained by open ditches and tile ²	acres..	47,227		11,719		10,928	201	10,920	10,051	
33	Length of these drains.....	miles..	503.1		98.1		167.2	1.5	155.0	113.4	
34	Average length per acre.....	feet..	56.2		44.2		76.0	27.7	74.9	59.6	
DEVELOPMENT OF LAND.											
35	Improved land in operating enterprises, 1920.....	acres..	56,193	8,303	60,023	275,330	14,146	20,109	10,711	11,128	22,507
36	Improved land prior to drainage.....	acres..	19,077	2,859	30,386	160,169		12,545	5,794	1,540	9,146
37	Increase since drainage.....	acres..	37,116	5,444	29,637	115,161	14,146	7,564	4,917	9,582	13,361
38	Per cent of increase.....	.....	194.6	190.4	97.9	71.9		60.3	84.9	610.8	146.1
39	Per cent increase is of all improved land in farms, 1920.....	.....	10.0	8.1	8.2	33.7	63.0	1.8	2.7	3.5	3.7
40	Timber and cut-over land, 1920.....	acres..		2,713		27,756	176,875				
41	Timber and cut-over land prior to drainage.....	acres..		3,093		53,707	176,875				
42	Decrease since drainage.....	acres..		380		25,951					
43	Per cent of decrease.....	.....		12.3		48.3					
44	Other unimproved land, 1920.....	acres..	8,954	5,523	6,256	195,208	516,475	6,458	6,010	3,362	9,258
45	Other unimproved land prior to drainage.....	acres..	46,070	10,587	35,943	284,418	530,621	14,022	10,927	12,044	22,610
46	Decrease since drainage.....	acres..	37,116	5,064	29,687	89,210	14,146	7,564	4,917	9,582	13,361
47	Per cent of decrease.....	.....	80.6	47.8	82.6	31.4	2.7	53.0	46.0	74.0	60.1
48	Swampy or subject to overflow, 1920.....	acres..	7,897	785	889	12,773	399,119	899	2,336	2,405	5,590
49	Swampy or subject to overflow prior to drainage.....	acres..	28,787	7,432	30,311	97,981	707,496	9,829	5,061	12,433	13,894
50	Decrease since drainage.....	acres..	20,890	6,647	29,422	85,208	308,377	8,930	2,725	9,008	8,204
51	Per cent of decrease.....	.....	72.6	89.4	97.1	87.0	43.6	90.9	53.8	80.2	69.6
CAPITAL INVESTED AND COST PER ACRE.											
52	Total capital invested in and required for completion of operating enterprises.....	dollars..	1,624,563	105,760	687,928	758,425	1,356,438	738,907	238,951	380,250	989,450
53	Capital invested in these enterprises to Dec. 31, 1919.....	dollars..	1,555,157	105,760	632,583	758,425	1,281,238	738,907	238,951	348,352	870,872
54	Additional capital required to complete these enterprises.....	dollars..	69,406		55,345		75,200			40,904	118,578
55	Average cost per acre when completed.....	dollars..	24.94	6.39	10.38	1.52	1.92	27.81	14.29	26.86	31.15
56	Enterprises constructing open ditches only.....	dollars..		105,760	356,789	758,425	1,356,438	214,045	220,178	51,304	98,699
57	Average cost per acre when completed.....	dollars..		6.39	6.78	1.52	1.92	17.05	13.77	20.01	12.41
58	Enterprises constructing tile drains only.....	dollars..	578,332		99,585			103,250		52,003	525,911
59	Average cost per acre when completed.....	dollars..	32.27		49.33			33.46		48.72	32.51
60	Enterprises constructing open ditches and tile drains.....	dollars..	1,046,231		234,554		421,609	12,773	285,289	304,870	
61	Average cost per acre when completed.....	dollars..	22.15		20.01		38.58	43.89	20.13	39.29	
CROPS.											
62	Improved land in enterprises reporting—										
63	Wheat as principal crop on drained land.....	acres..		8,303	11,688	275,330	14,146	20	2,970		
64	Hay as principal crop on drained land.....	acres..									
65	Corn as principal crop on drained land.....	acres..	56,193		48,385			20,089	7,741	9,503	22,507
66	Oats as principal crop on drained land.....	acres..									
67	Potatoes as principal crop on drained land.....	acres..									
68	Flax as principal crop on drained land.....	acres..									
69	Not reporting principal crop on drained land.....	acres..								1,318	
									307		
1 Office estimate; the reported figures are for 1919.											

¹ Office estimate; the reported figures are 68 per cent of the improved acreage in all farms in the county as determined by the census of agriculture.
² When works under construction have been completed.
³ The reported figures have been reduced in proportion to the reduction made in improved land, 1920.

DRAINAGE—MINNESOTA.

15

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		McLeod.	Mahnommen.	Marshall.	Martin.	Meeker.	Mille Lacs.	Morrison.	Mower.
LAND AREA.									
1	Approximate land area of the county.....acres	317,440	366,080	1,144,320	460,100	397,440	373,120	731,520	455,040
2	All land in operating drainage enterprises.....acres	14,072	36,724	771,421	67,985	21,227	7,172	33,080	4,771
3	Improved land.....acres	7,834	16,031	1,487,137	53,351	14,268	4,153	20,362	1,670
4	Per cent of all improved land in farms.....acres	3.1	19.5	98.1	14.3	5.1	5.2	8.9	0.5
5	Timber and cut-over land.....acres	233	1,448	154,858	189	578	2,309	48	48
6	Other unimproved land.....acres	6,005	19,245	120,426	14,614	6,770	2,441	10,409	3,053
7	Swampy or subject to overflow, in enterprises.....acres	3,868	13,714	30,856	7,105	2,591	277	1,506	426
8	Suffering a loss of crops from defective drainage.....acres	562	287	61,004	10,183	2,943	—	—	76
9	Assessed acreage.....acres	14,495	36,724	1,150,927	67,966	21,227	7,172	33,080	4,771
10	Excess over all land in operating enterprises.....acres	423	—	379,506	—	—	—	—	—
DRAINAGE WORKS.									
Open ditches:									
11	Completed.....miles	96.6	41.1	834.5	82.7	128.6	42.0	117.2	5.1
12	Additional under construction.....miles	—	53.8	—	—	—	—	0.8	—
13	Maximum completed in any enterprise.....miles	9.8	15.8	110.0	13.0	12.0	12.0	13.0	5.1
14	Maximum width at bottom of ditch ².....feet	16	12	40	14	24	8	10	16
15	Maximum of average depths of outlet ditches ².....feet	10.0	6.4	10.0	13.0	10.0	6.0	6.0	6.2
16	Mean depth of branch ditches ².....feet	4.2	4.8	4.9	7.2	4.7	3.4	3.2	—
Tile drains:									
17	Completed.....miles	51.3	—	—	718.8	16.9	—	—	13.5
18	Additional under construction.....miles	1.0	—	—	16.0	—	—	—	0.8
19	Maximum completed in any enterprise.....miles	12.0	—	—	51.9	6.0	—	—	7.6
20	Maximum size of tile ².....inches	24	—	—	36	24	—	—	30
Accessory levees and dikes:									
21	Completed.....miles	—	—	—	—	—	—	—	—
22	Additional under construction.....miles	—	—	—	—	—	—	—	—
23	Area drained by open ditches only ².....acres	8,757	36,724	771,421	2,166	19,785	7,172	33,080	—
24	Length of these ditches.....miles	70.5	94.4	834.5	18.3	127.6	42.0	118.0	—
25	Average length per acre.....feet	42.5	13.6	5.7	44.6	34.1	30.9	18.8	—
26	Area drained by tile only ².....acres	1,404	—	—	23,136	1,318	—	—	1,021
27	Length of these tile.....miles	14.3	—	—	343.6	14.9	—	—	6.7
28	Average length per acre.....feet	53.8	—	—	78.4	59.7	—	—	34.6
29	Area drained by open ditches and tile ².....acres	3,911	—	—	42,668	124	—	—	3,750
30	Length of these drains.....miles	64.1	—	—	455.6	3.0	—	—	12.7
31	Average length per acre.....feet	88.5	—	—	56.4	127.7	—	—	17.9
DEVELOPMENT OF LAND.									
32	Improved land in operating enterprises, 1920.....acres	7,834	16,031	1,487,137	53,351	14,268	4,153	20,362	1,670
33	Improved land prior to drainage.....acres	1,325	12,668	243,568	23,816	3,840	1,222	5,545	429
34	Increase since drainage.....acres	6,509	3,363	243,569	30,035	10,419	2,931	14,817	1,241
35	Per cent of increase.....	491.2	26.5	100.0	128.8	270.7	239.9	267.2	289.3
36	Per cent increase is of all improved land in farms, 1920.....	2.6	4.1	46.5	8.1	3.7	3.7	6.5	0.3
37	Timber and cut-over land, 1920.....acres	233	1,448	154,858	189	578	2,309	48	48
38	Timber and cut-over land prior to drainage.....acres	491	1,448	173,430	245	1,027	5,120	48	48
39	Decrease since drainage.....acres	258	—	18,572	56	449	2,811	—	—
40	Per cent of decrease.....	52.5	—	10.7	22.9	43.7	54.9	—	—
41	Other unimproved land, 1920.....acres	6,005	19,245	120,426	14,614	6,770	2,441	10,409	3,053
42	Other unimproved land prior to drainage.....acres	12,256	22,608	354,423	44,649	17,133	4,923	22,415	4,294
43	Decrease since drainage.....acres	6,251	3,363	224,997	30,035	10,363	2,482	12,006	1,241
44	Per cent of decrease.....	51.0	14.9	63.5	67.3	60.5	50.4	53.6	28.9
45	Swampy or subject to overflow, 1920.....acres	3,868	13,714	30,856	7,105	2,591	277	1,506	426
46	Swampy or subject to overflow prior to drainage.....acres	14,072	20,696	331,708	37,486	11,702	3,608	14,641	4,771
47	Decrease since drainage.....acres	10,204	6,982	300,852	30,381	9,111	3,331	13,135	4,345
48	Per cent of decrease.....	72.5	33.7	90.7	81.0	77.9	92.3	89.7	91.1
CAPITAL INVESTED AND COST PER ACRE.									
49	Total capital invested in and required for completion of operating enterprises.....dollars	285,092	267,573	2,069,234	1,857,548	249,787	34,192	99,019	85,020
50	Capital invested in these enterprises to Dec. 31, 1919.....dollars	283,506	92,573	2,069,234	1,793,548	249,787	34,192	99,019	77,520
51	Additional capital required to complete these enterprises.....dollars	2,486	175,000	—	64,000	—	—	3,000	7,500
52	Average cost per acre when completed.....dollars	20.32	7.29	2.68	27.33	11.77	4.77	2.99	17.82
53	Enterprises constructing open ditches only.....dollars	105,950	267,573	2,069,234	23,552	217,332	34,192	99,019	—
54	Average cost per acre when completed.....dollars	12.10	7.29	2.68	10.87	10.98	4.77	2.99	—
55	Enterprises constructing tile drains only.....dollars	28,298	—	—	760,448	28,804	—	—	34,619
56	Average cost per acre when completed.....dollars	20.16	—	—	32.87	21.86	—	—	33.91
57	Enterprises constructing open ditches and tile drains.....dollars	151,744	—	—	1,073,548	3,651	—	—	50,401
58	Average cost per acre when completed.....dollars	38.80	—	—	25.16	29.44	—	—	13.44
CROPS.									
59	Improved land in enterprises reporting—								
60	Wheat as principal crop on drained land.....acres	1,576	2,849	487,137	—	232	—	—	—
61	Hay as principal crop on drained land.....acres	27	—	—	31	4,525	3,765	12,451	—
62	Corn as principal crop on drained land.....acres	6,231	—	—	52,821	9,511	—	4,040	—
63	Oats as principal crop on drained land.....acres	—	13,132	—	—	—	—	—	1,670
64	Potatoes as principal crop on drained land.....acres	—	—	—	499	—	388	3,871	—
65	Flax as principal crop on drained land.....acres	—	—	—	—	—	—	—	—
66	Not reporting principal crop on drained land.....acres	—	—	—	—	—	—	—	—

¹ Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.² When works under construction have been completed.³ The reported figures have been reduced in proportion to the reduction made in improved land, 1920.

DRAINAGE—MINNESOTA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Murray.	Nicollet.	Nobles.	Norman.	Otter Tail.	Pennington.	Pine.	Pipe-stone.	Polk.
LAND AREA.										
1	Approximate land area of the county.....	450,560	283,520	462,080	550,400	1,304,960	388,480	904,320	300,100	1,206,500
2	All land in operating drainage enterprises.....	44,984	28,666	16,734	280,024	50,655	349,624	16,227	14,834	837,201
3	Improved land.....	35,225	16,053	12,069	166,386	25,384	186,310	8,636	14,092	557,509
4	Per cent of all improved land in farms.....	9.2	7.6	3.0	41.5	3.7	95.8	7.1	6.7	86.2
5	Timber and cut-over land.....	9,759	12,276	4,665	113,638	1,961	22,173	1,075	742	28,336
6	Other unimproved land.....	4,928	5,253	3,035	17,147	66,288	812	15,884	791	153,481
7	Swampy or subject to overflow, in enterprises.....	4,928	5,253	3,035	17,147	66,288	812	15,884	791	153,481
8	Suffering a loss of crops from defective drainage.....	44,084	13,911	17	280,024	50,655	349,624	16,227	14,834	837,201
9	Assessed acreage.....	44,084	13,911	17	280,024	50,655	349,624	16,227	14,834	837,201
10	Excess over all land in operating enterprises.....	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080	2,080
DRAINAGE WORKS.										
11	Open ditches:									
12	Completed.....	78.5	142.7	31.0	314.8	241.2	371.2	51.0	5.1	801.7
13	Additional under construction.....	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
14	Maximum completed in any enterprise.....	19.8	14.7	6.2	57.0	14.7	38.6	12.0	10	23.6
15	Maximum width at bottom of ditch.....	40	20	10	10	20	12	5.0	6.0	0.2
16	Maximum of average depths of outlet ditches.....	9.2	13.0	9.0	24.0	10.0	8.6	3.0	8.0	4.3
17	Mean depth of branch ditches.....	5.8	3.4	5.1	6.0	3.4	8.9	3.0	8.0	4.3
18	Tile drains:									
19	Completed.....	488.6	86.7	137.6	0.5	23.2	43.2	21.6	0.1	0.1
20	Additional under construction.....	33.6	3.0	10.2	0.5	8.2	43.2	21.6	0.1	0.1
21	Maximum completed in any enterprise.....	28.4	10.2	64.6	0.5	8.2	43.2	21.6	0.1	0.1
22	Maximum size of tile.....	36	28	42	15	24	32	24	24	24
23	Accessory levees and dikes:									
24	Completed.....	488.6	86.7	137.6	0.5	23.2	43.2	21.6	0.1	0.1
25	Additional under construction.....	33.6	3.0	10.2	0.5	8.2	43.2	21.6	0.1	0.1
26	Area drained by open ditches only.....	9,358	23,906	3,713	278,593	41,037	349,624	16,227	14,834	837,201
27	Length of these ditches.....	48.5	141.3	19.5	314.3	177.6	371.2	51.0	5.1	801.7
28	Average length per acre.....	27.4	31.1	27.7	8.0	22.9	5.0	16.6	6.1	6.1
29	Area drained by tile only.....	19,045	3,350	4,173	49	1.3	140.1	14,834	3,308	3,308
30	Length of these tile.....	327.0	18.4	58.3	1.3	140.1	14,834	3,308	3,308	3,308
31	Average length per acre.....	90.7	29.0	73.8	3.7	47.7	24.0	24.0	2.3	3.7
32	Area drained by open ditches and tile.....	16,681	1,320	8,848	1,431	9,469	14,834	3,308	3,308	3,308
33	Length of these drains.....	225.2	23.2	101.0	1.0	85.5	14,834	3,308	3,308	3,308
34	Average length per acre.....	71.7	92.8	60.3	3.7	47.7	24.0	24.0	2.3	3.7
DEVELOPMENT OF LAND.										
35	Improved land in operating enterprises, 1920.....	35,225	16,053	12,069	166,386	25,384	186,310	8,636	14,092	557,509
36	Improved land prior to drainage.....	13,664	9,292	5,819	8,206	8,206	8,206	2,811	11,126	233,080
37	Increase since drainage.....	21,561	6,761	6,250	166,386	16,878	99,556	5,825	2,966	324,429
38	Per cent of increase.....	157.8	72.8	107.4	198.4	104.4	114.7	207.2	26.7	133.3
39	Per cent increase is of all improved land in farms, 1920.....	8.6	3.2	1.8	41.5	2.6	51.2	4.8	1.2	38.4
40	Timber and cut-over land, 1920.....	9,759	12,276	4,665	113,638	23,210	141,132	6,516	742	251,416
41	Timber and cut-over land prior to drainage.....	31,320	19,019	10,915	280,024	38,724	229,237	12,237	3,708	501,642
42	Decrease since drainage.....	21,561	6,761	6,250	166,386	16,878	99,556	5,825	2,966	324,429
43	Per cent of decrease.....	68.8	35.5	57.3	50.4	40.1	38.4	46.8	80.0	55.2
44	Swampy or subject to overflow, 1920.....	4,928	5,253	3,035	17,147	66,288	812	15,884	791	153,481
45	Swampy or subject to overflow prior to drainage.....	17,052	10,091	8,473	280,024	45,143	132,016	8,000	3,708	307,181
46	Decrease since drainage.....	12,124	4,838	5,438	280,024	27,906	65,728	7,188	3,708	153,703
47	Per cent of decrease.....	71.1	47.9	64.2	100.0	62.0	49.8	80.0	100.0	50.0
CAPITAL INVESTED AND COST PER ACRE.										
48	Total capital invested in and required for completion of operating enterprises.....	1,448,271	342,445	545,660	670,666	316,154	603,010	89,274	269,175	1,111,537
49	Capital invested in these enterprises to Dec. 31, 1919.....	1,343,220	332,762	510,331	670,666	316,154	603,010	89,274	269,175	1,111,537
50	Additional capital required to complete these enterprises.....	105,051	9,683	35,329	0	0	0	0	0	0
51	Average cost per acre when completed.....	32.20	11.95	32.61	2.40	6.25	1.72	5.50	18.16	1.33
52	Enterprises constructing open ditches only.....	82,565	205,586	40,320	608,755	188,449	603,010	89,274	269,175	1,111,537
53	Average cost per acre when completed.....	8.82	8.57	10.86	2.40	4.60	1.72	5.50	18.16	1.33
54	Enterprises constructing tile drains only.....	823,622	71,370	130,834	2,169	44,06	0	0	0	0
55	Average cost per acre when completed.....	43.25	21.30	31.35	1,011	125,546	0	0	0	0
56	Enterprises constructing open ditches and tile drains.....	542,084	65,489	374,497	1,011	125,546	0	0	0	0
57	Average cost per acre when completed.....	32.60	49.61	42.33	1.34	13.28	0	0	0	0
CROPS.										
58	Improved land in enterprises reporting—									
59	Wheat as principal crop on drained land.....				165,738	228	67,540	8,636	14,092	237,600
60	Hay as principal crop on drained land.....				648	25,156	113,003	0	0	310,999
61	Corn as principal crop on drained land.....	34,425	4,256	12,069	0	0	0	0	0	0
62	Oats as principal crop on drained land.....		11,497	0	0	0	0	0	0	0
63	Potatoes as principal crop on drained land.....		300	0	0	0	0	0	0	0
64	Flax as principal crop on drained land.....		0	0	0	0	0	0	0	0
65	Not reporting principal crop on drained land.....	800	0	0	0	0	0	0	0	0

¹ Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.

² When works under construction have been completed.

³ The reported figures have been reduced in proportion to the reduction made in improved land, 1920.

DRAINAGE—MINNESOTA.

17

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Pope.	Ramsey.	Red Lake.	Red-wood.	Renville.	Rice.	Roseau.	St. Louis.	Sherburne.
LAND AREA.										
1	Approximate land area of the county.....acres..	443,520	103,040	276,480	563,840	625,920	316,800	1,068,800	4,161,920	286,720
2	All land in operating drainage enterprises.....acres..	11,402	4,172	146,649	65,146	89,579	4,909	1,086,824	217,689	20,597
3	Improved land.....acres..	7,676	1,866	77,468	40,844	61,816	3,078	1,210,948	23,134	11,674
4	Per cent of all improved land in farms.....	2.7	5.2	43.5	9.1	12.1	1.4	99.4	24.7	9.1
5	Timber and cut-over land.....acres..	208	231	5,802	20	29	.....	132,944	22,172	1,280
6	Other unimproved land.....acres..	3,518	2,075	63,379	24,282	27,734	1,831	692,932	172,383	7,643
7	Swampy or subject to overflow, in enterprises.....acres..	979	1,654	31,198	9,859	16,021	.....	71,028	61,433	737
8	Suffering a loss of crops from defective drainage.....acres..	1,434	282	5,665	15,733	17,408	1,183	99,739	903	.....
9	Assessed acreage.....	11,402	4,172	172,553	65,146	93,785	4,909	1,036,824	217,689	20,597
10	Excess over all land in operating enterprises.....acres..	.....	.....	25,904	.....	4,206	.....	.....	.....	.....
DRAINAGE WORKS.										
11	Open ditches:									
12	Completed.....miles..	69.4	37.4	158.4	174.4	343.9	43.8	1,091.1	654.8	140.0
13	Additional under construction.....miles..	0.1	5.1	.....	2.7	0.3	.....	.....	3.2	.....
14	Maximum completed in any enterprise.....miles..	11.7	8.1	20.6	34.0	23.6	9.7	212.1	150.0	25.0
15	Maximum width at bottom of ditch ².....feet..	20	8	12	24	25	20	60	24	6
16	Maximum of average depths of outlet ditches ².....feet..	14.0	6.0	5.5	12.0	13.0	5.5	10.0	10.0	7.0
17	Mean depth of branch ditches ².....feet..	3.8	3.5	3.7	4.3	4.0	4.0	5.0	5.5	3.6
18	Tile drains:									
19	Completed.....miles..	7.1	0.8	.....	479.8	332.4	7.3	.....	.....	5.8
20	Additional under construction.....miles..	0.6	.....	.....	63.8	38.3	.....	.....	.....	1.0
21	Maximum completed in any enterprise.....miles..	6.5	0.4	.....	38.6	76.5	6.0	.....	.....	2.0
22	Maximum size of tile ².....inches..	24	24	.....	36	42	16	.....	.....	36
23	Accessory levees and dikes:									
24	Completed.....miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	Additional under construction.....miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	Area drained by open ditches only ².....acres..	10,822	3,885	146,649	3,408	47,257	3,237	1,036,824	217,689	16,465
27	Length of these ditches.....miles..	87.9	40.2	158.4	25.7	261.3	33.4	1,091.1	658.0	105.0
28	Average length per acre.....feet..	33.1	54.6	5.7	89.9	29.2	54.5	5.6	16.0	33.7
29	Area drained by tile only ².....acres..	403	.....	.....	12,427	4,589	.....	.....	.....	130
30	Length of these tiles.....miles..	6.5	.....	.....	154.6	58.4	.....	.....	.....	2.0
31	Average length per acre.....feet..	85.2	.....	.....	65.7	67.2	.....	.....	.....	81.2
32	Area drained by open ditches and tile ².....acres..	177	287	.....	49,316	37,733	1,672	.....	.....	4,002
33	Length of these drains.....miles..	2.8	3.1	.....	540.4	395.2	17.7	.....	.....	39.8
34	Average length per acre.....feet..	83.5	57.0	.....	57.9	55.3	55.9	.....	.....	52.5
DEVELOPMENT OF LAND.										
35	Improved land in operating enterprises, 1920.....acres..	7,676	1,866	77,468	40,844	61,816	3,078	1,210,948	23,134	11,674
36	Improved land prior to drainage.....acres..	4,016	463	34,971	16,997	45,591	1,778	449,075	4,939	2,916
37	Increase since drainage.....acres..	3,660	1,403	42,497	23,847	16,225	1,300	161,873	18,175	8,768
38	Per cent of increase.....	91.1	303.0	121.5	140.3	35.6	73.1	329.8	365.5	300.3
39	Per cent increase is of all improved land in farms, 1920.....	1.3	3.9	26.6	5.3	3.2	0.6	76.3	19.4	6.8
40	Timber and cut-over land, 1920.....acres..	208	231	5,802	20	29	.....	132,944	22,172	1,280
41	Timber and cut-over land prior to drainage.....acres..	726	371	9,629	31	94	.....	132,944	24,227	2,769
42	Decrease since drainage.....acres..	518	140	3,827	11	65	.....	.....	2,055	1,479
43	Per cent of decrease.....	71.3	37.7	69.7	35.5	69.1	.....	.....	8.5	53.6
44	Other unimproved land, 1920.....acres..	3,518	2,075	63,379	24,282	27,734	1,831	692,932	172,383	7,643
45	Other unimproved land prior to drainage.....acres..	6,090	3,338	102,049	45,118	43,894	3,131	854,805	188,503	12,822
46	Decrease since drainage.....acres..	3,142	1,263	38,670	23,836	16,160	1,300	161,873	16,120	7,279
47	Per cent of decrease.....	47.2	37.8	37.9	49.5	36.8	41.5	18.9	8.6	48.8
48	Swampy or subject to overflow, 1920.....acres..	979	1,654	31,198	9,859	16,021	.....	71,028	61,433	737
49	Swampy or subject to overflow prior to drainage.....acres..	5,055	4,059	54,131	24,386	38,561	1,401	829,458	186,209	9,937
50	Decrease since drainage.....acres..	4,076	2,405	22,933	14,527	22,540	1,401	758,430	124,776	9,200
51	Per cent of decrease.....	80.6	59.3	42.4	59.6	58.5	100.0	91.4	67.0	92.6
CAPITAL INVESTED AND COST PER ACRE.										
52	Total capital invested in and required for completion of operating enterprises.....dollars..	124,912	86,857	188,572	1,895,940	1,875,171	102,191	1,768,122	1,033,797	176,302
53	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	123,112	71,857	188,572	1,597,448	1,774,271	102,191	1,768,122	1,028,797	174,002
54	Additional capital required to complete these enterprises.....dollars..	1,800	15,500	.....	298,492	100,900	.....	.....	5,000	1,700
55	Average cost per acre when completed.....dollars..	10.96	20.82	1.29	29.10	20.03	20.82	1.71	4.75	8.56
56	Enterprises constructing open ditches only.....dollars..	100,064	77,020	188,572	39,372	418,130	52,880	1,768,122	1,033,797	100,083
57	Average cost per acre when completed.....dollars..	9.25	19.82	1.20	11.57	8.85	16.34	1.71	4.75	6.08
58	Enterprises constructing tile drains only.....dollars..	17,235	.....	.....	344,928	141,681	.....	.....	.....	3,032
59	Average cost per acre when completed.....dollars..	42.77	.....	.....	27.76	30.87	.....	.....	.....	23.32
60	Enterprises constructing open ditches and tile drains.....dollars..	7,613	9,837	.....	1,511,640	1,315,360	49,311	.....	.....	73,187
61	Average cost per acre when completed.....dollars..	43.01	34.28	.....	30.65	34.86	29.49	.....	.....	18.29
CROPS.										
62	Improved land in enterprises reporting—									
63	Wheat as principal crop on drained land.....acres..	5,950	.....	4,859	.....	60,773	.....	210,948	.....	.....
64	Hay as principal crop on drained land.....acres..	1,691	1,113	55,570	2,927	.....	602	.....	23,134	11,400
65	Corn as principal crop on drained land.....acres..	.....	26	.....	37,917	1,043	2,476	.....	.....	130
66	Oats as principal crop on drained land.....acres..	.....	513	17,039	.....	.....	.....	.....	.....	.....
67	Potatoes as principal crop on drained land.....acres..	.....	169	.....	.....	.....	.....	.....	.....	144
68	Flax as principal crop on drained land.....acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
69	Not reporting principal crop on drained land.....acres..	35	45	.....	.....	.....	.....	.....	.....	.....

¹ Office estimate; the reported figures exceed the improved acreage in all farms in the county as determined by the census of agriculture.² When works under construction have been completed.³ The reported figures have been reduced in proportion to the reduction made in improved land, 1920.

DRAINAGE—MINNESOTA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Sibley.	Stearns.	Steele.	Stevens.	Swift.	Todd.	Traverse.	Wabasha.
LAND AREA.									
1	Approximate land area of the county.....acres..	374,400	871,680	275,840	360,960	474,240	612,480	363,620	346,240
2	All land in operating drainage enterprises.....acres..	21,357	26,283	17,679	44,232	65,840	46,785	171,595	7,527
3	Improved land.....acres..	9,837	21,760	12,373	26,857	50,429	18,394	156,906	4,892
4	Per cent of all improved land in farms.....	3.6	4.4	5.8	9.6	12.9	7.6	52.2	2.2
5	Timber and cut-over land.....acres..	266	441	—	—	—	—	—	151
6	Other unimproved land.....acres..	11,254	4,082	5,306	17,375	15,411	28,391	14,689	2,484
7	Swampy or subject to overflow, in enterprises.....acres..	7,421	2,094	—	4,604	2,369	—	—	1,129
8	Suffering a loss of crops from defective drainage.....acres..	2,033	1,215	—	1,599	8,599	—	22,441	—
9	Assessed acreage.....	21,357	26,283	17,679	44,232	65,840	46,785	171,595	7,527
10	Excess over all land in operating enterprises.....acres..	—	—	—	—	—	—	—	—
DRAINAGE WORKS.									
11	Open ditches:								
12	Completed.....miles..	201.3	197.4	81.0	99.8	100.6	359.2	194.9	2.6
13	Additional under construction.....miles..	2.2	—	—	21.4	—	0.8	—	—
14	Maximum completed in any enterprise.....miles..	14.9	20.0	28.0	19.8	29.7	33.0	21.6	2.5
15	Maximum width at bottom of ditch.....feet..	20	10	20	20	50	20	16	30
16	Maximum of average depths of outlet ditches.....feet..	13.0	10.0	7.0	15.0	14.0	9.0	11.0	15.0
17	Mean depth of branch ditches.....feet..	8.7	4.0	3.9	5.0	5.1	3.3	3.4	—
18	Tile drains:								
19	Completed.....miles..	9.2	9.5	32.0	89.2	270.7	1.0	3.1	—
20	Additional under construction.....miles..	50.8	—	—	4.2	—	—	—	—
21	Maximum completed in any enterprise.....miles..	3.1	3.0	17.0	18.3	153.0	1.0	1.6	—
22	Maximum size of tile.....inches..	24	24	28	48	30	20	14	—
23	Accessory levees and dikes:								
24	Completed.....miles..	—	—	—	—	—	—	—	—
25	Additional under construction.....miles..	—	—	—	—	—	—	—	—
26	Area drained by open ditches only.....acres..	17,429	25,104	12,014	9,709	35,002	46,385	170,208	7,527
27	Length of these ditches.....miles..	186.5	196.4	75.0	56.9	60.9	358.0	192.5	2.5
28	Average length per acre.....feet..	56.5	41.2	33.0	30.9	9.2	40.8	6.0	1.8
29	Area drained by tile only.....acres..	474	884	2,172	11,479	4,247	—	712	—
30	Length of these drains.....miles..	6.2	6.5	14.0	45.4	41.0	—	1.6	—
31	Average length per acre.....feet..	69.1	38.8	34.0	20.9	51.0	—	11.9	—
32	Area drained by open ditches and tile.....acres..	3,454	235	3,493	23,044	26,531	400	675	—
33	Length of these drains.....miles..	70.8	4.0	24.0	112.3	269.4	3.0	3.9	—
34	Average length per acre.....feet..	108.2	89.9	36.3	25.7	53.6	39.6	30.5	—
DEVELOPMENT OF LAND.									
35	Improved land in operating enterprises, 1920.....acres..	9,837	21,760	12,373	26,857	50,429	18,394	156,906	4,892
36	Improved land prior to drainage.....acres..	2,162	8,179	1,688	15,060	26,000	—	153,608	1,506
37	Increase since drainage.....acres..	7,675	13,581	10,685	11,797	24,429	18,394	3,300	3,387
38	Per cent of increase.....	357.1	166.0	633.0	78.3	94.0	—	2.1	225.0
39	Per cent increase is of all improved land in farms, 1920.....	2.8	2.7	5.0	4.2	6.2	7.6	1.1	1.5
40	Timber and cut-over land, 1920.....acres..	266	441	—	—	—	—	—	151
41	Timber and cut-over land prior to drainage.....acres..	603	532	—	—	221	1,076	—	151
42	Decrease since drainage.....acres..	337	91	—	—	221	1,076	—	—
43	Per cent of decrease.....	55.0	17.1	—	—	100.0	100.0	—	—
44	Other unimproved land, 1920.....acres..	11,254	4,082	5,306	17,375	15,411	28,391	14,689	2,484
45	Other unimproved land prior to drainage.....acres..	18,602	17,572	15,991	29,172	39,619	45,709	17,989	5,871
46	Decrease since drainage.....acres..	7,348	13,490	10,685	11,797	24,208	17,318	3,300	3,387
47	Per cent of decrease.....	39.5	76.8	66.8	40.4	61.1	37.9	18.3	57.7
48	Swampy or subject to overflow, 1920.....acres..	7,421	2,094	—	4,604	2,369	—	—	1,129
49	Swampy or subject to overflow prior to drainage.....acres..	21,302	12,312	13,407	22,069	28,818	44,500	—	6,022
50	Decrease since drainage.....acres..	13,881	10,218	13,407	17,465	26,449	44,500	—	4,893
51	Per cent of decrease.....	65.2	83.0	100.0	79.1	91.8	100.0	—	81.3
CAPITAL INVESTED AND COST PER ACRE.									
52	Total capital invested in and required for completion of operating enterprises.....dollars..	442,906	275,221	212,619	599,836	1,064,494	318,492	297,428	14,694
53	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	207,022	275,221	212,619	564,130	1,064,494	318,492	297,428	14,694
54	Additional capital required to complete these enterprises.....dollars..	235,884	—	—	35,700	—	—	—	—
55	Average cost per acre when completed.....dollars..	20.74	10.47	12.03	13.56	16.17	6.81	1.73	1.95
56	Enterprises constructing open ditches only.....dollars..	177,863	240,558	107,901	157,652	228,008	313,889	292,907	14,694
57	Average cost per acre when completed.....dollars..	10.21	9.56	8.98	16.24	6.52	6.77	1.72	1.95
58	Enterprises constructing tile drains only.....dollars..	12,357	28,965	38,868	139,189	101,876	—	3,348	—
59	Average cost per acre when completed.....dollars..	26.07	32.77	17.60	12.13	23.99	—	4.70	—
60	Enterprises constructing open ditches and tile drains.....dollars..	252,686	5,700	65,850	302,995	734,010	4,603	1,173	—
61	Average cost per acre when completed.....dollars..	73.16	24.26	18.85	13.15	27.67	11.51	1.74	—
CROPS.									
62	Improved land in enterprises reporting—								
63	Wheat as principal crop on drained land.....acres..	3,646	10,256	—	28,857	50,429	—	156,906	—
64	Hay as principal crop on drained land.....acres..	—	—	—	—	—	—	—	—
65	Corn as principal crop on drained land.....acres..	6,191	11,504	—	—	—	18,394	—	—
66	Oats as principal crop on drained land.....acres..	—	—	—	—	—	—	—	—
67	Potatoes as principal crop on drained land.....acres..	—	—	—	—	—	—	—	—
68	Flax as principal crop on drained land.....acres..	—	—	—	—	—	—	—	—
69	Not reporting principal crop on drained land.....acres..	—	—	—	—	—	—	—	—

¹ When works under construction have been completed.² Barley.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Wadena.	Waseca.	Wash- ington.	Watson- wan.	Wilkin.	Wright.	Yellow Medicine.	Other counties. ¹
LAND AREA.									
1	Approximate land area of the county.....acres..	344,320	275,840	254,080	277,760	476,800	442,240	479,360	1,297,280
2	All land in operating drainage enterprises.....acres..	51,937	10,076	8,804	15,158	237,948	13,362	12,775	12,220
3	Improved land.....acres..	17,109	6,007	4,557	13,906	146,620	7,756	8,495	8,232
4	Per cent of all improved land in farms.....	16.7	3.1	2.9	6.2	37.6	3.0	2.2	1.0
5	Timber and cut-over land.....acres..	2,707		850		4,029	852		516
6	Other unimproved land.....acres..	32,121	4,069	3,997	1,252	87,299	4,754	4,280	3,472
7	Swampy or subject to overflow, in enterprises.....acres..			2,765		36,713	1,662	2,978	3,135
8	Suffering a loss of crops from defective drainage.....acres..			474		6,281	1,690	1,181	451
9	Assessed acreage.....acres..	51,937	10,076	8,804	15,158	237,199	13,362	12,775	12,220
10	Excess over all land in operating enterprises.....acres..					49,251			
DRAINAGE WORKS.									
11	Open ditches:								
12	Completed.....miles.....	172.8	59.0	25.5	20.0	283.2	94.2	31.9	74.0
13	Additional under construction.....miles.....	0.2				1.1		0.4	1.0
14	Maximum completed in any enterprise.....miles.....	30.0	12.0	12.5	6.0	40.5	11.0	7.7	19.6
15	Maximum width at bottom of ditch.....feet.....	20	12	10	10	20	20	12	72
16	Maximum of average depths of outlet ditches.....feet.....	6.0	6.0	7.2	7.0	8.0	9.0	8.4	10.8
17	Mean depth of branch ditches.....feet.....	3.4	3.1	4.3	4.9	3.9	3.6	4.3	4.7
18	Tile drains:								
19	Completed.....miles.....			6.0	182.0		24.0	51.5	18.8
20	Additional under construction.....miles.....							7.9	
21	Maximum completed in any enterprise.....miles.....			6.0	40.0		8.0	11.0	10.5
22	Maximum size of tile.....inches.....			18	36		28	30	42
23	Accessory levees and dikes:								
24	Completed.....miles.....								
25	Additional under construction.....miles.....								
26	Area drained by open ditches only.....acres..	51,937	10,076	8,110		237,948	11,125	3,986	8,878
27	Length of these ditches.....miles.....	173.0	59.0	23.5		284.3	81.7	24.6	74.3
28	Average length per acre.....feet.....	17.6	30.9	15.3		6.3	38.8	32.6	44.2
29	Area drained by tile only.....acres..				8,549		158	4,125	
30	Length of these tile.....miles.....				87.0		1.0	42.6	
31	Average length per acre.....feet.....				70.1		33.4	54.5	
32	Area drained by open ditches and tile.....acres..			694	8,699		2,079	4,664	3,342
33	Length of these drains.....miles.....			8.0	115.0		35.5	24.5	19.5
34	Average length per acre.....feet.....			60.9	70.5		90.2	27.7	30.8
DEVELOPMENT OF LAND.									
35	Improved land in operating enterprises, 1920.....acres..	17,109	6,007	4,557	13,906	146,620	7,756	8,495	8,232
36	Improved land prior to drainage.....acres..		574	571	398	104,150	1,540	597	3,487
37	Increase since drainage.....acres..	17,109	5,433	3,986	13,508	42,470	6,216	7,898	4,745
38	Per cent of increase.....		94.5	698.1		40.8	403.6		136.1
39	Per cent increase is of all improved land in farms, 1920.....	16.7	2.8	2.5	6.0	10.9	2.4	2.0	0.6
40	Timber and cut-over land, 1920.....acres..	2,707		850		4,029	852		516
41	Timber and cut-over land prior to drainage.....acres..	3,761		1,409		4,868	909		673
42	Decrease since drainage.....acres..	1,054		559		839	117		157
43	Per cent of decrease.....	28.0		39.7		17.2	12.1		23.3
44	Other unimproved land, 1920.....acres..	32,121	4,069	3,997	1,252	87,299	4,754	4,280	3,472
45	Other unimproved land prior to drainage.....acres..	48,170	9,502	6,824	14,760	128,980	10,853	12,178	8,000
46	Decrease since drainage.....acres..	16,059	5,433	3,427	13,508	41,681	6,099	7,898	4,588
47	Per cent of decrease.....	33.3	57.2	50.2	91.5	32.3	56.2	64.9	56.9
48	Swampy or subject to overflow, 1920.....acres..			2,765		36,713	1,662	2,978	3,135
49	Swampy or subject to overflow prior to drainage.....acres..	50,607	8,902	8,804	10,600	95,339	7,320	12,346	8,740
50	Decrease since drainage.....acres..	50,607	8,902	6,039	10,600	58,626	5,658	9,368	5,605
51	Per cent of decrease.....	100.0	100.0	68.6	100.0	61.6	77.4	75.9	64.1
CAPITAL INVESTED AND COST PER ACRE.									
52	Total capital invested in and required for completion of operating enter- prises.....dollars.....	164,543	81,715	58,217	450,516	741,575	217,897	227,128	449,285
53	Capital invested in these enterprises to Dec. 31, 1919.....dollars.....	164,543	81,715	58,217	450,516	721,575	217,897	212,850	399,285
54	Additional capital required to complete these enterprises.....dollars.....					20,000		14,278	50,000
55	Average cost per acre when completed.....dollars.....	3.17	8.11	6.61	29.72	3.12	16.31	17.78	36.77
56	Enterprises constructing open ditches only.....dollars.....	164,543	81,715	41,490		741,575	138,614	19,474	343,555
57	Average cost per acre when completed.....dollars.....	3.17	8.11	5.12		3.12	12.46	4.89	38.70
58	Enterprises constructing tile drains only.....dollars.....				196,416		3,656	127,098	
59	Average cost per acre when completed.....dollars.....				29.99		23.14	80.81	
60	Enterprises constructing open ditches and tile drains.....dollars.....			16,727	254,100		75,627	80,556	105,730
61	Average cost per acre when completed.....dollars.....			24.10	29.52		36.38	17.27	31.64
CROPS.									
62	Improved land in enterprises reporting—								
63	Wheat as principal crop on drained land.....acres..	17,109	6,007	3,812	2,529	89,485	1,045		1,205
64	Hay as principal crop on drained land.....acres..			745	11,377	57,135	4,767	568	6,436
65	Corn as principal crop on drained land.....acres..						1,954	7,061	
66	Oats as principal crop on drained land.....acres..								
67	Potatoes as principal crop on drained land.....acres..							866	
68	Flax as principal crop on drained land.....acres..								
69	Not reporting principal crop on drained land.....acres..								

¹ Includes only Dakota, Houston, Rock, and Scott Counties.
² When works under construction have been completed.
³ Per cent not shown when more than 1,000.

FOURTEENTH CENSUS OF THE UNITED STATES: 1920

DEPARTMENT
OF COMMERCE

BULLETIN

BUREAU OF
THE CENSUS

DRAINAGE : MISSISSIPPI

STATISTICS FOR THE STATE AND ITS COUNTIES

Prepared under the supervision of WILLIAM LANE AUSTIN, Chief Statistician for Agriculture, by ROGER D. MARSDEN, Special Agent in Charge of Drainage

CONTENTS.

	Page.		Page.
INTRODUCTION.....	1	DRAINAGE ENTERPRISES—Continued.	
MAP SHOWING OPERATING DRAINAGE ENTERPRISE	2	Size of enterprises.....	4
DRAINAGE ON FARMS.....	3	Character of enterprises.....	5
Explanation of terms.....	3	Drainage works.....	6
Farms and farm land.....	3	Maintenance of works.....	7
DRAINAGE ENTERPRISES.....	3	Date of organization.....	7
Explanation of terms.....	3	Crops.....	8
Operating and nonoperating enterprises.....	4	COUNTY TABLES:	
Location of enterprises.....	4	I.—Drainage on farms: 1920.....	8
Condition of land in enterprises.....	4	II.—Operating drainage enterprises: 1920.....	10

INTRODUCTION.

This bulletin presents the statistics of drainage for Mississippi collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises include considerable areas of timbered and other unimproved land not yet

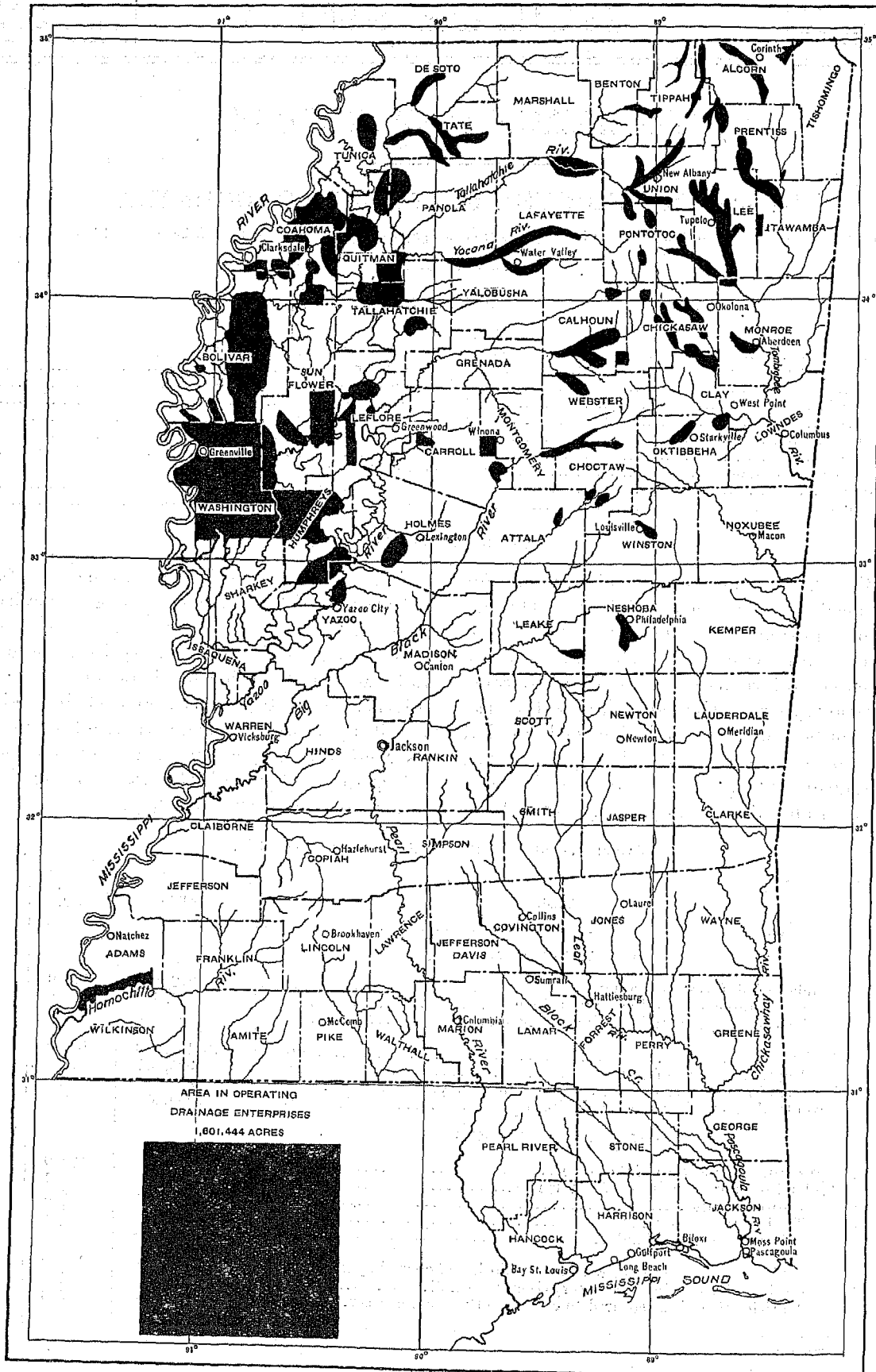
in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
DRAINAGE ON FARMS.		
Number of all farms in the state.....	272, 101	100.0
Farms reporting land having drainage.....	34, 926	12.8
Farms reporting land needing drainage.....	29, 872	11.0
All land in farms..... acres..	18, 196, 979	100.0
Improved land in farms..... acres..	9, 325, 677	51.2
Farm land reported as provided with drainage..... acres..	825, 878	4.5
Farm land reported as needing drainage..... acres..	1, 455, 534	8.0
DRAINAGE ENTERPRISES.		
Approximate land area of the state..... acres..	29, 671, 680	100.0
All land in operating drainage enterprises..... acres..	1, 601, 444	5.4
Improved land..... acres..	941, 239	3.2
Timber and cut-over land..... acres..	631, 964	2.1
Other unimproved land..... acres..	28, 241	0.1
Capital invested in and required for completion of operating enterprises..	\$8, 561, 264	100.0
Capital invested in these enterprises to Dec. 31, 1919.....	\$7, 076, 164	82.7
Additional capital required to complete these enterprises.....	\$1, 485, 100	17.3

MISSISSIPPI.

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



DRAINAGE ON FARMS.

Explanation of terms.—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which are substantially as follows:

Drainage of agricultural land was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purpose of improving the condition of the soil and crops.

The area provided with drainage, in farms, is the acreage actually benefited or made of more value for agricultural purposes by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land not now suitable for crops which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators have answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual." Levee districts, however, generally are not included in the enterprises for which data are given in this bulletin (see definition of drainage enterprises, below).

Farms and farm land.—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for growing crops by reason of the drainage. This is to be distinguished from the area merely provided with outlet facilities by organized drainage enterprises. Drainage on farms represents in most cases the result of work done by the farm owner, either independently or supplemental to the work done by a drainage enterprise, but the acreage would include also any farm land receiving similar benefits directly from the works of an enterprise.

DRAINAGE ENTERPRISES.

Explanation of terms.—The more important terms used in connection with the census of drainage enterprises were defined as follows:

Drainage enterprises comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swamp or overflowed land for sale, other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditches or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise, though the capacities of drainage pumping plants are given only in the counties in which the plants are located.

Operating enterprises, as designated in this bulletin, are those that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

Land in drainage enterprises comprises the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises, deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (a) improved land; (b) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (c) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be considerably greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprises.

Timber and cut-over land includes farm woodland of natural or

planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, land subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering loss of crops is intended to include only land devoted to planted crops which suffer damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A pumping district is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of reclamation some years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also districts for which the order of establishment had just been issued and which were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. ¹		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises..	1, 879, 001	100.0	\$7, 192, 907	100.0	\$4, 060, 333
Operating enterprises.....	1, 601, 444	85.2	7, 076, 164	98.4	1, 485, 100
With works completed.....	1, 175, 776	62.6	5, 522, 944	76.8	.....
With works under construction.....	425, 668	22.7	1, 553, 220	21.6	1, 485, 100
Nonoperating enterprises.....	277, 557	14.8	116, 743	1.6	2, 575, 233

¹ The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—Practically all of the drainage enterprises are in the northern half of the state, and about three-fourths of the land in such enterprises is situated in 10 counties near Mississippi River.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises..	1, 879, 001	100.0	\$7, 192, 907	100.0	\$4, 060, 333
Operating enterprises.....	1, 601, 444	85.2	7, 076, 164	98.4	1, 485, 100
Pearl River.....	24, 027	1.3	192, 300	2.7	85, 000
Tombigbee River.....	131, 554	7.0	837, 034	11.6	.....
Yazoo River.....	1, 355, 499	72.1	5, 687, 607	79.1	1, 397, 100
Tennessee River.....	3, 900	0.2	34, 000	0.5	.....
Mississippi River.....	80, 464	4.6	325, 223	4.5	3, 000
Nonoperating enterprises.....	277, 557	14.8	116, 743	1.6	2, 575, 233
Pearl River.....	6, 102	0.3	6, 081	0.1	90, 959
Pascagoula River.....	4, 583	0.2	4, 700	0.1	81, 300
Tombigbee River.....	11, 828	0.6	6, 750	0.1	105, 500
Yazoo River.....	235, 447	12.5	87, 212	1.2	2, 201, 883
Mississippi River.....	7, 462	0.4	10, 800	0.2	48, 800
Gulf of Mexico.....	12, 135	0.6	1, 200	(¹)	46, 701

¹ Less than one-tenth of 1 per cent.

For both operating and nonoperating enterprises, approximately 85 per cent of the acreage is drained into Yazoo River.

Condition of land in enterprises.—The drainage enterprises in the region between Yazoo and Mississippi Rivers are principally for the reclamation of level swamp areas. This region is of alluvial formation, and was subject to inundation by overflow from the Mississippi until construction of the extensive system of levees along that stream. Storm run-off from the higher rolling land on the east also overflowed parts of the delta land. The characteristic high banks of the natural watercourses greatly interfere with drainage of the surface water into the channels that exist. In the counties east of Yazoo River, the drainage problem generally is one of relieving the bottom land along the streams from overflow by floods of short duration.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflow for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	1, 601, 444	100.0	1, 175, 776	425, 668	277, 557
Improved land.....	941, 239	58.8	768, 105	173, 134	107, 852
Timber and cut-over land....	631, 064	39.5	383, 633	248, 331	137, 406
Other unimproved land.....	28, 241	1.8	24, 038	4, 203	32, 299
Swampy or subject to overflow..	261, 126	16.3	210, 422	50, 704	103, 211
Suffering a loss of crops.....	12, 207	0.8	7, 167	5, 040	948

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided and the part in each county be considered a separate enterprise. In this way 167 operating drainage enterprises are counted in Mississippi, with an average area of 9,608 acres assessed. The assessed acreage exceeds the land in enterprises by 3,040 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed acreage, deduction was made for the amount of overlapping with enterprises organized previously, to determine the acreage to be tabulated as land in enterprises.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

AREA ASSESSED.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	1,601,444	1,604,484	100.0
200 to 499 acres.....	1,894	1,894	0.1
500 to 999 acres.....	8,989	9,789	0.6
1,000 to 4,999 acres.....	199,000	201,240	12.5
5,000 to 9,999 acres.....	157,416	157,416	9.8
10,000 to 49,999 acres.....	664,285	664,285	41.4
50,000 to 99,999 acres.....	320,400	320,400	20.0
100,000 acres and over.....	249,460	249,460	15.5

Character of enterprises.—The drainage enterprises in Mississippi are swamp land districts and drainage districts established by the county boards of supervisors, by the chancery courts, or by county boards of drainage commissioners in accordance with the general drainage laws of the state, and private undertakings by individual landowners.

Swamp land districts for the reclamation of wet, swamp, or overflowed land are formed in accordance with an act of February 19, 1902 (ch. 70), which now forms sections 371 to 391 (ch. 17) of the Mississippi Code of 1906 of the public statute laws. A petition for establishment, signed by a majority of the resident landowners owning at least one-third of the land to be drained, is filed with the board of supervisors of the county where the proposed district is situated. Three commissioners named in the petition determine what land will be drained by the same system of connecting channels, and the county supervisors may decree the district established. A special tax upon the district is levied by the supervisors, not exceeding 50 cents per acre in any year, and when a sufficient amount has been collected the commissioners let contracts for constructing the drains. Right of way may be obtained by condemnation. Upon petition from one-third of the landowners, the county supervisors may issue bonds in anticipation of the full amount of taxes authorized to be levied for not exceeding 30 years.

Drainage districts may be established by the county boards of supervisors under a law of March 1, 1912 (ch. 195), or under one of March 16, 1912 (ch. 198). The former act, as amended, requires that a petition for establishment be signed by 10 per cent of the landowners in the proposed district. The supervisors appoint an engineer, and may appoint three temporary commissioners also, to make a report as to the land that will be benefited and the probable cost of the drainage improvements. Hearings are held upon the petition and upon the engineer's report, before the supervisors decree the district established. The executive officers of the enterprise are three commissioners appointed by the board of supervisors, though the selection may be determined by petition signed by a majority of the landowners. The plan of drainage

works and the assessments of damages and benefits are made by the commissioners, the assessments being subject to confirmation by the board of supervisors and to appeal to the chancery court. The assessments for cost are made by the county supervisors against the real property in the district, in proportion to the benefits. Bonds may be issued by the commissioners to run not more than 30 years. For a district in more than one county, proceedings are before the chancery court instead of the county supervisors. Subdistricts may be formed in accordance with an act of February 26, 1914 (ch. 269), wholly or partly within a drainage district organized under the act of March 1, 1912 (ch. 195). The manner of establishment is similar to that for an original district, but the petition must be signed by one-third of the landowners owning a majority of the acreage or by a majority of the owners owning a third of the acreage or real property. The commissioners of the main district serve also for the subdistrict. An independent district may be formed wholly or partly within another district, under the statute of 1914, upon petition similar to that required for a subdistrict.

The establishment of a drainage district under the act of March 16, 1912 (ch. 198), requires a petition to the county supervisors from a majority of the resident landowners who shall own one-third of the land. Three commissioners named in the petition are the officers of the district to determine the plan of drainage and to assess damages if any are claimed. The cost of construction has been paid by a uniform tax upon the land benefited. However, three-fourths of the owners holding half or more of the land may petition for assessments according to benefits, and then the commissioners must divide the land into five classes to be assessed, per acre, in the ratio 5:4:3:2:1. Public hearings are held upon the petition and upon the commissioners' plan of improvement, and appeals regarding classification of the land may be taken to the chancery court. Rights of way may be condemned. Bonds may be issued upon petition from a majority of the landowners owning a majority of the acreage, to be paid by special tax levies not exceeding \$1 per acre in any year.

Drainage districts under the chancery courts, except intercounty districts formed under the act of March 1, 1912, are established in accordance with a law of April 12, 1906 (ch. 132), which is now chapter 39 of the Mississippi Code of 1906. This statute as amended provides for a board of three drainage commissioners for the county, to be elected by the drainage taxpayers of the county, if 20 per cent of the owners of real property affected by constructed or proposed drainage works petition for such commissioners. Before 1916, this board was elected by the county supervisors when petition for the first drainage district had been approved by the chancery court. Petition for a district

under this law must be filed with the chancery court of the county containing the greatest part of the proposed district, signed by a majority of the landowners owning at least one-third of the land to be affected or by one-third of the owners holding a majority of the acreage. The drainage commissioners investigate regarding the practicability of the project, and after public hearing upon their report the chancery court may decree the district established. The commissioners determine the plan of drainage, and assess damages and benefits subject to confirmation by the court after public hearing. Rights of way may be secured as in eminent domain cases. Bonds may be issued by the commissioners, payable in 1 to 20 years.

An act of March 13, 1912 (ch. 197), also provides for a county board of three drainage commissioners for each county embracing all or a part of one or more drainage districts, to have jurisdiction over all such districts within the county organized under this act. These commissioners are appointed by the chancellors of the chancery districts. Petition for establishment of the drainage district must be signed by 10 per cent of the landowners of the proposed district, in number, acreage, or value, and be filed with the clerk of the chancery court of the county containing the greater part of that district. If the petition is sufficient, the county drainage commissioners refer it to three district drainage commissioners whom they appoint to investigate regarding the feasibility and utility of the project. The district is established by the county drainage commissioners after public hearing upon the district commissioners' report, if the proposed work will be beneficial to the landowners. The county drainage commissioners are the corporate authority of the district. The cost of the enterprise is apportioned against the tracts of land in proportion to benefits. Damages and benefits are assessed by the district commissioners and confirmed by the county drainage commissioners, subject to appeal to the chancery court. Rights of way may be obtained by proceedings before the courts of eminent domain. Bonds may be issued by the county commissioners for not exceeding 30 years.

A private drain may be constructed across land of an objecting owner, if necessary, by petition to the county supervisors and payment of damages assessed, under an act of March 15, 1918 (ch. 206).

The first drainage law of Mississippi was passed in 1886, applicable only in Lee County, authorizing the county supervisors to drain swamp and overflowed land upon petition from the owners of a majority of the acreage. A law of February 11, 1898 (ch. 39), authorized the issue of bonds for reclamation work upon petition from landowners, by counties having authority to levy taxes on swamp and overflowed land. An act of March 6, 1900, applicable in all counties, was similar to the swamp land district act of 1902,

which repealed both the act of 1900 and that of 1898. A few counties were excepted from the provisions of chapter 39 of the Code of 1906 until 1912. Of the many amendments to the drainage laws of the state, the few that affect the character of the enterprises have been incorporated in the foregoing statement.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	1,879,001	100.0	\$7,192,907	100.0	\$4,080,333
Operating enterprises.....	1,601,444	85.2	7,076,164	98.4	1,485,100
Swamp land districts:					
Code of 1906, ch. 17.....	305,018	16.2	1,221,009	17.0	3,000
Drainage districts:					
Code of 1906, ch. 39.....	540,567	28.8	2,652,761	36.9	68,000
Laws of 1912, ch. 195.....	652,202	34.7	2,330,078	32.4	1,056,500
Laws of 1912, ch. 197.....	41,498	2.2	291,216	4.0	95,000
Laws of 1912, ch. 198.....	5,400	0.3	49,500	0.7	.....
Individual ownerships.....	56,750	3.0	531,000	7.4	262,000
Nonoperating enterprises.....	277,557	14.8	116,743	1.6	2,575,233
Drainage districts:					
Code of 1906, ch. 39.....	31,062	1.7	19,800	0.3	254,800
Laws of 1912, ch. 195.....	240,753	12.8	92,481	1.3	2,244,895
Laws of 1912, ch. 197.....	5,742	0.3	4,462	0.1	75,538

Drainage works.—The total works completed by the drainage enterprises to December 31, 1919, comprised 1,815.1 miles of open ditches, 238.8 miles of tile drains, and 6.7 miles of accessory levees; the additional lengths under construction were 223.6 miles of ditches, 54.2 miles of tile drains, and 36.8 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There is one pumping district for land drainage among the enterprises under construction in Mississippi. Part of the drainage water from 44,000 acres is to be removed by two centrifugal pumps of 78,000 gallons per minute capacity, operated by internal-combustion engines capable of developing 250 horsepower.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	1,601,444	100.0	\$7,076,164	100.0	\$1,485,100
Open ditches only.....	1,274,464	79.6	5,846,352	82.6	974,600
Open ditches and levees.....	279,230	17.4	768,812	10.9	308,500
Open ditches and tile drains ¹ ...	47,750	3.0	461,000	6.5	142,000

¹ Includes 8,300 acres drained by tile only.

TABLE 8.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY TYPE OF DRAINAGE: 1920.

TYPE OF DRAINAGE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises....	1,601,444	100.0	\$7,076,164	100.0	\$1,485,100
Gravity drainage only.....	1,504,044	93.9	6,691,064	94.6	1,180,100
Part gravity and part pumping.....	97,400	6.1	385,100	5.4	325,000
Total area served by pumps....	44,000	2.7	.....	.....	.....

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches, which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet and those 10 feet and greater were omitted as it seemed they do not represent so well the average depths of outlet provided for all the farms in those districts; to include these groups, computed as 3 feet and 10 feet, respectively, would show the mean depth for the state 6.9 instead of 6.8 feet.

TABLE 9.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	1,601,444	100.0
Less than 3 feet.....	2,000	0.1
3.0 to 3.9 feet.....	30,000	1.9
4.0 to 4.9 feet.....	41,758	2.6
5.0 to 5.9 feet.....	43,248	2.7
6.0 to 6.9 feet.....	413,980	25.9
7.0 to 7.9 feet.....	127,365	8.0
8.0 to 8.9 feet.....	471,362	29.4
9.0 to 9.9 feet.....	65,000	4.1
10.0 feet and more.....	406,131	25.4
Not reporting branches.....	.....	.....

Maintenance of works.—The statutes provide for maintenance of the improvement works of all the public drainage enterprises in Mississippi. The county supervisors are charged with protecting and keeping in repair the drainage works of swamp land districts organized under chapter 17 of the Code of 1906, and

are authorized to levy assessments against the districts to pay for that work. The commissioners of drainage districts established under chapters 195 and 198 of the laws of 1912 are authorized to borrow money to pay for maintenance of the drainage works, payment to be made from taxes levied against the districts by county supervisors. In districts under chapter 195, notice and hearing must be given before any levy is made; in those under chapter 198, the levy must not exceed 25 cents per acre in any year. Chapter 39 of the Code of 1906 provides that the boards of drainage commissioners may do any and all acts necessary in repairing and maintaining any drain or other work for which they have been appointed, and may make additional assessments to pay the cost involved. For districts formed in accordance with chapter 197 of the laws of 1912, the district drainage commissioners may, with the approval of the county board of drainage commissioners, do anything necessary for repairing and maintaining the works of the district, and the county supervisors shall levy taxes against the districts each year, if requested by the drainage commissioners, to pay for the maintenance work. The county board of drainage commissioners supervises the maintenance of the districts in case there are no district drainage commissioners.

TABLE 10.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises..	1,601,444	100.0	\$7,076,164	100.0	\$1,485,100
By district forces.....	778,767	48.6	3,295,081	46.6	1,009,600
By contract.....	460,185	28.7	2,151,353	30.4	20,000
By landowners.....	45,920	2.9	431,000	6.8	242,000
No maintenance provided.....	316,572	19.8	1,148,730	16.2	213,500

Date of organization.—The progress of development in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the county commissioners, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of reclamation was completed.

DRAINAGE—MISSISSIPPI.

TABLE 11.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	1,601,444	100.0	1,604,484	100.0
1890 to 1899.....	3,950	0.2	3,950	0.2
1900 to 1904.....	11,929	0.7	11,929	0.7
1905 to 1909.....	244,013	15.2	246,053	15.3
1910 to 1914.....	907,062	56.6	907,062	56.5
1915 to 1919.....	434,490	27.1	436,490	27.1

TABLE 12.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$7,076,164	100.0	\$1,485,100
1890 to 1899.....	96,000	1.4	56,000
1900 to 1904.....	208,000	2.9	50,000
1905 to 1909.....	878,090	12.4	26,000
1910 to 1914.....	4,211,398	59.5	180,000
1915 to 1919.....	1,682,676	23.8	1,173,100

TABLE 13.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	2,038.7	100.0	293.0	100.0	43.5	100.0
1890 to 1899.....	20.0	1.0	32.0	10.9	.....	.....
1900 to 1904.....	52.0	2.6	52.0	17.7	.....	.....
1905 to 1909.....	234.5	11.5	93.0	31.7	.....	.....
1910 to 1914.....	1,143.3	56.1	84.0	28.7	6.5	14.9
1915 to 1919.....	588.9	28.9	32.0	10.9	37.0	85.1

Crops.—The principal crops grown upon the drained land in the drainage enterprises are cotton and corn. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Alcorn.	Amite.	Attala.	Benton.	Bolivar.	Calhoun.	Carroll.	Chick- asaw.
1	Number of all farms in the state or county.....	272,101	2,901	3,148	4,024	1,904	12,808	3,266	3,963	3,055
2	Farms reporting land having drainage.....	34,926	1,090	259	242	260	2,265	424	273	593
3	Farms reporting land needing drainage.....	29,872	927	657	1,052	268	166	698	153	335
4	Farms in drainage and levee districts.....	13,496	335	1	26	62	1,673	343	66	155
LAND AND FARM AREA.										
5	Approximate land area of the state or county.....acres..	29,671,680	247,040	456,960	457,600	253,440	562,560	370,560	399,360	320,040
6	All land in farms.....acres..	18,198,979	198,752	287,305	385,388	201,077	326,311	281,401	341,306	241,907
7	Improved land in farms.....acres..	9,325,677	91,553	126,201	184,716	70,215	291,324	112,329	168,718	140,597
8	Woodland in farms.....acres..	7,014,898	92,553	145,169	141,721	89,346	29,041	126,478	116,222	63,651
9	Other unimproved land in farms.....acres..	1,856,404	14,646	16,935	58,951	41,516	5,946	42,594	56,366	37,659
10	Farm land reported as provided with drainage.....acres..	825,878	32,972	9,785	6,004	4,435	47,668	14,239	13,090	17,466
11	Farm land reported as needing drainage.....acres..	1,455,534	37,618	46,279	49,440	12,615	2,348	41,538	14,578	13,565
12	Drainage only.....acres..	151,179	3,349	1,988	5,368	1,360	1,385	1,406	6,979	1,905
13	Drainage and clearing.....acres..	1,304,355	34,269	44,291	44,072	11,255	963	40,132	7,599	11,660

		Choctaw.	Clai- borne.	Clay.	Coa- homa.	Copiah.	Coving- ton.	De Soto.	Harri- son.	Hinds.	Holmes.	Hum- phreys.
1	Number of all farms in the county.....	2,188	2,154	2,793	8,628	4,349	2,151	4,858	720	5,951	6,240	3,695
2	Farms reporting land having drainage.....	335	144	254	888	101	51	128	36	555	1,176	379
3	Farms reporting land needing drainage.....	702	321	83	57	200	215	210	55	812	244	33
4	Farms in drainage and levee districts.....	126	7	4	701	1	.....	32	4	.....	13	372
LAND AND FARM AREA.												
5	Approximate land area of the county.....acres..	264,960	312,960	261,120	339,200	492,100	262,400	304,000	364,800	549,120	480,640	261,120
6	All land in farms.....acres..	228,010	244,556	180,737	212,023	377,399	179,288	229,480	55,746	391,016	353,309	122,445
7	Improved land in farms.....acres..	75,416	113,483	127,641	185,614	210,712	68,127	173,794	11,578	209,816	212,052	97,452
8	Woodland in farms.....acres..	124,750	102,384	48,431	25,767	146,031	107,783	37,383	37,032	73,565	98,951	21,870
9	Other unimproved land in farms.....acres..	27,844	28,684	4,665	642	20,656	3,378	18,303	7,136	47,635	42,306	3,123
10	Farm land reported as provided with drainage.....acres..	9,496	2,238	7,345	15,662	1,930	539	2,757	648	7,766	18,265	8,874
11	Farm land reported as needing drainage.....acres..	52,790	13,692	5,224	3,923	12,226	9,054	6,117	1,797	30,341	10,805	5,292
12	Drainage only.....acres..	3,384	2,631	860	561	996	350	104	345	2,401	1,744	26
13	Drainage and clearing.....acres..	49,406	11,061	4,364	3,362	11,230	8,704	6,013	1,452	27,940	9,061	5,266

DRAINAGE—MISSISSIPPI.

9

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

	Issaquena.	Itawamba.	Jackson.	Jasper.	Jones.	Lafayette.	Lauderdale.	Leake.	Lee.	Leflore.	Lowndes.
1 Number of all farms in the county.....	1,914	3,064	688	2,790	2,666	3,388	3,076	3,492	4,768	5,667	3,020
2 Farms reporting land having drainage.....	800	991	23	137	295	36	163	206	1,322	961	198
3 Farms reporting land needing drainage.....	396	1,463	49	326	1,191	292	150	863	450	200	317
4 Farms in drainage and levee districts.....	787	186	.....	1	5	41	.....	34	597	502	3
LAND AND FARM AREA.											
5 Approximate land area of the county..... acres..	259,840	338,560	454,400	426,880	445,440	424,060	448,000	368,640	286,720	366,080	319,360
6 All land in farms..... acres..	96,379	261,629	97,078	274,615	229,259	310,373	271,573	204,502	238,358	209,976	246,537
7 Improved land in farms..... acres..	54,067	90,701	14,566	100,211	76,400	129,067	109,730	108,461	149,002	166,733	159,947
8 Woodland in farms..... acres..	38,388	137,392	55,662	150,194	131,876	127,563	131,614	108,097	49,464	37,168	69,680
9 Other unimproved land in farms..... acres..	3,294	32,036	26,860	24,210	20,983	52,843	30,229	47,944	39,892	6,075	16,910
10 Farm land reported as provided with drainage..... acres..	16,805	12,935	517	1,078	1,621	1,377	1,794	2,675	27,385	24,092	6,795
11 Farm land reported as needing drainage..... acres..	15,835	51,696	4,198	14,812	62,466	13,645	6,473	42,730	13,366	18,807	21,492
12 Drainage only..... acres..	7,660	1,116	18	1,558	865	1,497	1,975	4,144	459	3,878	5,796
13 Drainage and clearing..... acres..	8,185	50,490	4,180	13,254	61,601	12,148	4,498	38,586	12,907	14,929	15,696
	Madison.	Monroe.	Montgomery.	Neshoba.	Newton.	Noxubee.	Oktibbeha.	Panola.	Perry.	Pike.	Pontotoc.
1 Number of all farms in the county.....	5,260	5,026	1,988	3,054	3,237	4,242	2,816	4,960	834	2,889	3,934
2 Farms reporting land having drainage.....	36	436	289	831	501	375	224	211	48	558	1,697
3 Farms reporting land needing drainage.....	279	504	268	805	956	199	364	494	111	704	967
4 Farms in drainage and levee districts.....	.....	8	31	87	3	.....	20	186	.....	138	585
LAND AND FARM AREA.											
5 Approximate land area of the county..... acres..	461,000	492,800	254,720	359,040	363,520	436,480	292,480	445,440	412,160	280,480	316,160
6 All land in farms..... acres..	347,366	395,013	197,696	240,694	283,054	303,740	217,188	320,654	90,774	207,965	274,007
7 Improved land in farms..... acres..	249,767	205,431	88,830	103,552	128,963	210,844	128,028	202,607	22,806	85,912	139,806
8 Woodland in farms..... acres..	62,207	168,416	73,321	117,027	140,024	75,016	73,584	81,513	51,056	118,239	87,540
9 Other unimproved land in farms..... acres..	35,392	21,106	35,545	20,115	14,067	17,880	15,576	36,574	17,412	3,844	46,602
10 Farm land reported as provided with drainage..... acres..	2,453	13,420	11,463	14,784	8,772	13,487	7,402	4,946	515	13,824	37,475
11 Farm land reported as needing drainage..... acres..	9,070	34,741	15,300	25,148	44,862	15,694	22,771	22,081	4,520	20,815	37,509
12 Drainage only..... acres..	4,527	6,781	4,713	2,932	5,276	4,169	2,564	2,466	50	635	5,421
13 Drainage and clearing..... acres..	4,543	27,960	10,593	22,190	39,586	11,525	20,207	20,488	4,476	20,180	32,088
	Prentiss.	Quitman.	Rankin.	Scott.	Sharkey.	Simpson.	Smith.	Sunflower.	Tallahatchie.	Tate.	Tippah.
1 Number of all farms in the county.....	3,144	4,315	3,231	2,248	3,142	2,522	2,695	9,668	6,495	3,955	2,702
2 Farms reporting land having drainage.....	1,431	139	109	67	807	658	561	3,116	549	170	497
3 Farms reporting land needing drainage.....	993	204	520	353	77	776	730	146	387	160	300
4 Farms in drainage and levee districts.....	410	92	2	8	828	1	.....	836	2	89	249
LAND AND FARM AREA.											
5 Approximate land area of the county..... acres..	261,760	252,800	506,240	382,080	270,080	368,000	400,640	431,360	402,560	256,000	285,440
6 All land in farms..... acres..	219,708	123,590	296,455	207,357	78,936	187,360	227,734	261,519	281,743	194,587	256,480
7 Improved land in farms..... acres..	100,678	102,128	134,238	92,220	68,724	82,927	91,206	220,497	174,478	138,753	107,222
8 Woodland in farms..... acres..	89,218	19,768	133,430	98,449	9,766	94,801	116,525	38,074	58,549	33,701	110,354
9 Other unimproved land in farms..... acres..	29,812	1,694	28,781	16,688	446	9,622	20,003	2,948	48,416	22,133	38,904
10 Farm land reported as provided with drainage..... acres..	26,816	1,537	4,210	852	10,681	16,166	9,438	67,920	12,815	6,253	10,833
11 Farm land reported as needing drainage..... acres..	23,392	9,179	43,204	17,657	4,665	42,072	30,423	6,696	7,445	4,497	9,008
12 Drainage only..... acres..	2,181	605	7,317	2,506	368	1,161	3,220	1,322	595	400	655
13 Drainage and clearing..... acres..	21,261	8,574	35,887	15,151	4,297	40,911	27,203	5,674	6,850	4,097	8,348
	Tishomingo.	Tunica.	Union.	Washington.	Wayne.	Webster.	Wilkinson.	Winston.	Yalobusha.	Yazoo.	All other counties. ¹
1 Number of all farms in the county.....	2,250	4,936	3,519	9,281	1,828	2,221	2,436	2,814	2,594	6,663	37,833
2 Farms reporting land having drainage.....	412	805	1,350	2,803	147	453	118	117	504	97	105
3 Farms reporting land needing drainage.....	559	154	1,225	145	225	377	244	823	828	19	1,870
4 Farms in drainage and levee districts.....	.....	859	483	2,292	2	33	.....	14	63	.....	43
LAND AND FARM AREA.											
5 Approximate land area of the county..... acres..	273,920	267,520	263,680	462,720	519,680	266,240	426,880	382,060	313,600	579,200	6,902,400
6 All land in farms..... acres..	189,089	104,449	224,085	316,932	196,354	215,609	234,868	259,745	288,755	409,532	3,195,866
7 Improved land in farms..... acres..	65,168	117,239	109,132	230,317	87,017	86,259	107,700	101,825	102,813	243,581	1,334,242
8 Woodland in farms..... acres..	113,671	33,632	69,042	69,819	132,966	105,006	98,309	131,906	92,710	132,913	1,515,678
9 Other unimproved land in farms..... acres..	10,260	18,678	45,911	17,296	6,371	24,544	23,799	26,614	43,226	33,038	342,946
10 Farm land reported as provided with drainage..... acres..	7,313	21,885	34,210	86,118	3,310	12,907	8,934	2,482	23,429	3,794	1,377
11 Farm land reported as needing drainage..... acres..	24,517	19,022	25,461	24,373	15,071	30,169	17,509	55,336	47,675	848	100,012
12 Drainage only..... acres..	2,107	4,647	1,245	4,788	399	1,689	503	1,706	4,274	405	3,454
13 Drainage and clearing..... acres..	22,410	14,375	24,210	19,585	14,672	28,480	17,006	56,630	43,401	448	102,558

¹ No drainage on farms reported in Adams, Clarke, Greene, Jefferson Davis, Marion, Pearl River, Walthall, and Warren Counties.

DRAINAGE—MISSISSIPPI.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Adams.	Alcorn.	Attala.	Benton.	Bolivar.	Calhoun.	Carroll.	Chickasaw.
LAND AREA.										
1	Approximate land area of the state or county.....	acres.. 29,671,680	272,640	247,040	457,600	253,440	562,560	370,560	399,360	320,640
2	All land in operating drainage enterprises.....	acres.. 1,001,444	29,183	26,883	4,798	4,000	184,896	29,852	8,200	22,218
3	Improved land.....	acres.. 941,239	5,253	13,102	1,919	1,600	125,386	12,972	6,990	19,052
4	Per cent of all improved land in farms.....	10.1	6.4	14.3	1.0	2.3	43.0	11.5	4.1	13.6
5	Timber and cut-over land.....	acres.. 631,964	23,930	13,781	2,879	2,400	44,425	10,880	1,240	3,166
6	Other unimproved land.....	acres.. 28,241					15,084			
7	Swampy or subject to overflow, in enterprises.....	acres.. 261,126	29,183	26,600	2,880		19,950			170
8	Suffering loss of crops from defective drainage.....	acres.. 12,207					5,040			
9	Assessed acreage.....	1,604,484	29,183	26,883	4,798	4,000	184,896	29,852	8,200	22,218
10	Excess over all land in operating enterprises.....	acres.. 3,040								
DRAINAGE WORKS.										
	Open ditches:									
11	Completed.....	miles.. 1,815.1	3.8	66.2	10.0	8.5	139.7	31.0	9.9	54.5
12	Additional under construction.....	miles.. 223.6	1.2				16.8			
13	Maximum completed in any enterprise.....	miles.. 121.0	3.8	38.0	10.0	8.5	50.0	12.0	7.5	15.0
14	Maximum width at bottom of ditch ¹	feet.. 120	8	20	21	8	60	30	30	20
15	Maximum of average depths of outlet ditches ¹	feet.. 20.0	10.0	9.0	15.0	8.0	11.0	10.0	15.0	8.0
16	Mean depth of branch ditches ¹	feet.. 6.8		6.0			5.7	7.0		5.3
	Tile drains:									
17	Completed.....	miles.. 238.8					80.0			
18	Additional under construction.....	miles.. 54.2					3.5			
19	Maximum completed in any enterprise.....	miles.. 80.0					80.0			
20	Maximum size of tile ¹	inches.. 36					36			
	Accessory levees and dikes:									
21	Completed.....	miles.. 6.7								
22	Additional under construction.....	miles.. 36.8								
	Pumping plants:									
23	Engine capacity.....	horsepower.. 250								
24	Pump capacity.....	gallons per minute.. 78,000								
25	Area served by pumps.....	acres.. 44,000								
26	Area drained by open ditches only ¹	acres.. 1,274,464	29,183	26,883	4,798	4,000	171,590	29,852	8,200	22,218
27	Length of these ditches.....	miles.. 1,686.1	5.0	66.2	10.0	8.5	114.5	31.0	9.9	54.5
28	Average length per acre.....	feet.. 7.0	0.9	13.0	11.0	11.2	3.5	5.5	6.3	13.0
29	Area having open ditches and levees ¹	acres.. 279,230								
30	Length of these ditches.....	miles.. 259.1								
31	Average length per acre.....	feet.. 4.9								
32	Length of the accessory levees.....	miles.. 43.5								
33	Area drained by open ditches and tile ¹	acres.. 247,750					13,300			
34	Length of these drains.....	miles.. 357.5					125.5			
35	Average length per acre.....	feet.. 42.8					49.8			
DEVELOPMENT OF LAND.										
36	Improved land in operating enterprises, 1920.....	acres.. 941,239	5,253	13,102	1,919	1,600	125,386	12,972	6,990	19,052
37	Improved land prior to drainage.....	acres.. 506,828	5,253	4,542	960	800	74,568	3,963	3,100	13,142
38	Increase since drainage.....	acres.. 434,411		8,660	950	800	60,818	9,009	3,890	5,910
39	Per cent of increase.....	85.7		188.5	99.9	100.0	88.1	227.3	124.5	45.0
40	Per cent increase is of all improved land in farms, 1920.....	4.7		9.3	0.5	1.1	17.4	8.0	2.3	4.2
41	Timber and cut-over land, 1920.....	acres.. 631,964	23,930	13,781	2,879	2,400	44,425	10,880	1,240	3,166
42	Timber and cut-over land prior to drainage.....	acres.. 1,012,215	23,930	22,341	3,838	3,200	62,169	25,889	2,560	8,348
43	Decrease since drainage.....	acres.. 380,251		8,560	950	800	7,733	9,009	1,340	5,182
44	Per cent of decrease.....	37.6		38.3	25.0	25.0	14.8	34.8	51.9	62.1
45	Other unimproved land, 1920.....	acres.. 28,241					15,084			
46	Other unimproved land prior to drainage.....	acres.. 82,401					55,169			
47	Decrease since drainage.....	acres.. 54,160					43,085			
48	Per cent of decrease.....	65.7					74.1			
49	Swampy or subject to overflow, 1920.....	acres.. 261,126	29,183	26,600	2,880		19,950			170
50	Swampy or subject to overflow, prior to drainage.....	acres.. 627,415	29,183	26,883	4,798	4,000	68,625			1,492
51	Decrease since drainage.....	acres.. 366,289		283	1,918	4,000	48,675			1,322
52	Per cent of decrease.....	58.4		1.1	40.0	100.0	71.1			88.6
CAPITAL INVESTED AND COST PER ACRE.										
53	Total capital invested in and required for completion of operating enterprises.....	dollars.. 8,561,264	20,650	131,220	30,000	23,500	1,022,473	148,000	32,000	214,500
54	Capital invested in these enterprises to Dec. 31, 1919.....	dollars.. 7,076,164	17,650	131,220	30,000	23,500	843,473	148,000	32,000	214,500
55	Additional capital required to complete these enterprises.....	dollars.. 1,485,100	3,000				179,000			
56	Average cost per acre when completed.....	dollars.. 5.35	0.71	4.88	6.25	5.88	5.53	4.96	3.90	9.65
57	Enterprises constructing open ditches only.....	dollars.. 6,820,952	20,650	131,220	30,000	23,500	778,473	148,000	32,000	214,500
58	Average cost per acre when completed.....	dollars.. 5.35	0.71	4.88	6.25	5.88	4.54	4.96	3.90	9.65
59	Enterprises constructing open ditches and levees.....	dollars.. 1,137,312								
60	Average cost per acre when completed.....	dollars.. 4.07								
61	Enterprises constructing open ditches and tile drains.....	dollars.. 803,000					244,000			
62	Average cost per acre when completed.....	dollars.. 12.63					18.35			
CROPS.										
63	Improved land in enterprises reporting—									
64	Cotton as principal crop on drained land.....	acres.. 804,391	5,253	1,920	1,919		124,528	6,000	3,600	19,052
	Corn as principal crop on drained land.....	acres.. 136,848		11,182		1,600	858	6,972	3,360	

¹ When works under construction have been completed. ² Includes 8,800 acres drained by tile only. ³ Includes cost of 2 enterprises constructing 112 miles of tile only.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Choctaw.	Clay.	Cochosa.	De Soto.	Holmes.	Humphreys.	Itawamba.	Lafayette.	Lee.	LeFlore.
LAND AREA.											
1	Approximate land area of the county.....acres..	264,960	261,120	339,200	304,000	480,040	261,120	338,560	424,960	286,720	366,080
2	All land in operating drainage enterprises.....acres..	14,975	12,293	172,000	5,500	25,000	158,500	9,097	18,839	49,234	34,007
3	Improved land.....acres..	6,433	7,236	138,171	1,650	17,500	81,550	5,708	10,205	44,989	24,383
4	Per cent of all improved land in farms.....	8.5	5.7	74.4	0.9	8.3	83.7	6.3	7.9	30.2	14.6
5	Timber and cut-over land.....acres..	6,274	5,057	33,829	3,850	7,500	76,950	3,389	8,634	4,245	9,624
6	Other unimproved land.....acres..	2,268									
7	Swampy or subject to overflow, in enterprises.....acres..			9,798				9,097		49,234	
8	Suffering loss of crops from defective drainage.....acres..			6,259							
9	Assessed acreage.....	14,975	12,293	175,040	5,500	25,000	158,500	9,097	18,839	49,234	34,007
10	Excess over all land in operating enterprises.....acres..			3,040							
DRAINAGE WORKS.											
Open ditches:											
11	Completed.....miles..	40.6	20.5	213.8	14.0	8.0	130.6	18.0	19.0	92.6	43.0
12	Additional under construction.....miles..			1.2		8.0					
13	Maximum completed in any enterprise.....miles..	15.0	14.0	38.0	14.0	8.0	117.0	9.0	11.0	11.0	11.5
14	Maximum width at bottom of ditch ¹.....feet..	15	25	30	8	30	20	10	20	40	25
15	Maximum of average depths of outlet ditches ¹.....feet..	10.0	6.0	20.0	3.0	10.0	12.0	10.0	14.0	15.0	10.0
16	Mean depth of branch ditches ¹.....feet..			6.5			8.0			8.0	4.6
Tile drains:											
17	Completed.....miles..			150.2							
18	Additional under construction.....miles..			47.3							
19	Maximum completed in any enterprise.....miles..			50.0							
20	Maximum size of tile ¹.....inches..			36							
Accessory levees and dikes:											
21	Completed.....miles..						3.6				
22	Additional under construction.....miles..										
Pumping plants:											
23	Engine capacity.....horsepower..										
24	Pump capacity.....gallons per minute..										
25	Area served by pumps.....acres..										
26	Area drained by open ditches only ¹.....acres..	14,975	12,293	144,850	5,500	25,000		9,097	18,839	49,234	34,007
27	Length of these ditches.....miles..	40.6	20.5	169.5	14.0	16.0		18.0	19.0	92.6	43.0
28	Average length per acre.....feet..	14.3	8.8	6.2	13.4	3.4		10.4	5.3	9.9	6.7
29	Area having open ditches and levees ¹.....acres..						158,500				
30	Length of these ditches.....miles..						130.6				
31	Average length per acre.....feet..						4.4				
32	Length of the accessory levees.....miles..						3.6				
33	Area drained by open ditches and tile ¹.....acres..			27,150							
34	Length of these drains.....miles..			243.0							
35	Average length per acre.....feet..			47.3							
DEVELOPMENT OF LAND.											
36	Improved land in operating enterprises, 1920.....acres..	6,433	7,236	138,171	1,650	17,500	81,550	5,708	10,205	44,989	24,383
37	Improved land prior to drainage.....acres..	1,497	6,006	69,089	1,100	12,500	38,535	633	6,876	28,036	4,101
38	Increase since drainage.....acres..	4,936	1,230	69,082	550	5,000	43,015	5,075	3,329	16,953	20,282
39	Per cent of increase.....	329.7	20.5	100.0	50.0	40.0	111.6	801.7	48.4	60.5	494.6
40	Per cent increase is of all improved land in farms, 1920.....	6.5	1.0	37.2	0.3	2.4	44.1	5.6	2.6	11.4	12.2
41	Timber and cut-over land, 1920.....acres..	6,274	5,057	33,829	3,850	7,500	76,950	3,389	8,634	4,245	9,624
42	Timber and cut-over land prior to drainage.....acres..	9,138	6,287	102,521	4,400	12,500	119,965	8,464	11,963	21,198	29,906
43	Decrease since drainage.....acres..	2,864	1,230	68,692	550	5,000	43,015	5,075	3,329	16,953	20,282
44	Per cent of decrease.....	31.3	19.6	67.0	12.5	40.0	35.9	60.0	27.8	80.0	67.8
45	Other unimproved land, 1920.....acres..	2,268									
46	Other unimproved land prior to drainage.....acres..	4,340		390							
47	Decrease since drainage.....acres..	2,072		390							
48	Per cent of decrease.....	47.7		100.0							
49	Swampy or subject to overflow, 1920.....acres..			9,798				9,097		49,234	
50	Swampy or subject to overflow prior to drainage.....acres..			46,836				9,097		49,234	23,039
51	Decrease since drainage.....acres..			37,038							23,039
52	Per cent of decrease.....			79.1							100.0
CAPITAL INVESTED AND COST PER ACRE.											
53	Total capital invested in and required for completion of operating enterprises.....dollars..	100,209	62,500	985,822	12,000	110,000	528,000	68,732	176,076	276,644	139,380
54	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	100,209	62,500	899,822	12,000	50,000	528,000	68,732	162,676	276,644	139,380
55	Additional capital required to complete these enterprises.....dollars..			86,000		60,000			13,400		
56	Average cost per acre when completed.....dollars..	6.69	5.08	5.73	2.18	4.40	3.33	7.56	9.35	5.62	4.10
57	Enterprises constructing open ditches only.....dollars..	100,209	62,500	665,822	12,000	110,000		68,732	176,076	276,644	139,380
58	Average cost per acre when completed.....dollars..	6.69	5.08	4.60	2.18	4.40		7.56	9.35	5.62	4.10
59	Enterprises constructing open ditches and levees.....dollars..						528,000				
60	Average cost per acre when completed.....dollars..						3.33				
61	Enterprises constructing open ditches and tile drains.....dollars..			320,000							
62	Average cost per acre when completed.....dollars..			11.79							
CROPS.											
63	Improved land in enterprises reporting—										
64	Cotton as principal crop on drained land.....acres..	6,433	7,236	136,809	1,650	17,500	81,550	5,708	8,270	36,689	24,383
	Corn as principal crop on drained land.....acres..			1,362					1,935	8,300	

¹ When works under construction have been completed.

DRAINAGE—MISSISSIPPI.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Mar- shall.	Monroe.	No- shoba.	Oktib- beha.	Panola.	Pon- totoc.	Pren- tiss.	Quitman.	Sun- flower.	Talla- hatchie.
LAND AREA.											
1	Approximate land area of the county.....acres..	440,900	492,800	359,040	292,480	445,440	316,100	261,760	252,800	431,300	402,560
2	All land in operating drainage enterprises.....acres..	8,740	6,262	11,418	12,150	10,934	17,109	18,844	72,647	90,460	26,300
3	Improved land.....acres..	2,185	5,572	400	5,798	11,820	13,576	10,144	30,284	55,449	11,700
4	Per cent of all improved land in farms.....	1.3	2.7	0.4	4.5	5.8	9.7	10.1	29.7	25.1	0.7
5	Timber and cut-over land.....acres..	6,555	690	11,018	4,282	8,114	3,533	8,700	41,700	35,011	9,600
6	Other unimproved land.....acres..				2,070				573		5,000
7	Swampy or subject to overflow, in enterprises.....acres..		6,262	5,709	4,009	1,000		6,878	1,023	35,011	2,500
8	Suffering loss of crops from defective drainage.....acres..								300		
9	Assessed acreage.....	8,740	6,262	11,418	12,150	10,934	17,109	18,844	72,647	90,460	26,300
10	Excess over all land in operating enterprises.....acres..										
DRAINAGE WORKS.											
11	Open ditches:										
12	Completed.....miles..	9.5	17.0	9.9	23.0	23.0	45.5	52.5	61.7	110.0	4.9
13	Additional under construction.....miles..	3.2		8.1		11.2		3.4	38.9		5.1
14	Maximum completed in any enterprise.....miles..	9.5	10.0	9.9	17.0	22.2	12.5	8.1	44.4	32.0	4.0
15	Maximum width at bottom of ditch ¹.....feet..	24	26	40	20	35	20	18	35	120	100
16	Maximum of average depths of outlet ditches ¹.....feet..	18.0	12.0	10.0	9.0	8.0	9.0	10.0	11.0	14.0	12.0
17	Mean depth of branch ditches ¹.....feet..			8.0	4.7	6.9	8.0	7.0	6.7	6.8	7.0
18	Tile drains:										
19	Completed.....miles..								2.0		6.6
20	Additional under construction.....miles..										3.4
21	Maximum completed in any enterprise.....miles..								2.0		6.6
22	Maximum size of tile ¹.....inches..								20		30
23	Accessory levees and dikes:										
24	Completed.....miles..										
25	Additional under construction.....miles..					5.0			25.5		2.5
26	Pumping plants:										
27	Engine capacity.....horsepower..										
28	Pump capacity.....gallons per minute..										
29	Area drained by open ditches only ¹.....acres..	8,740	6,262	11,418	12,150	1,600	17,109	18,844	10,711	90,460	10,000
30	Length of these ditches.....miles..	12.7	17.0	18.0	23.0	2.2	45.5	55.9	15.1	110.0	4.0
31	Average length per acre.....feet..	7.7	14.3	8.3	10.0	7.3	14.0	15.7	7.4	6.4	2.1
32	Area having open ditches and levees ¹.....acres..					18,334			58,036		12,000
33	Length of these ditches.....miles..					32.0			78.5		6.0
34	Average length per acre.....feet..					9.2			7.0		2.6
35	Length of the accessory levees.....miles..					5.0			25.5		2.5
36	Area drained by open ditches and tile ¹.....acres..								3,000		4,300
37	Length of these drains.....miles..								9.0		10.0
38	Average length per acre.....feet..								15.8		12.3
DEVELOPMENT OF LAND.											
39	Improved land in operating enterprises, 1920.....acres..	2,185	5,572	400	5,798	11,820	13,576	10,144	30,284	55,449	11,700
40	Improved land prior to drainage.....acres..	2,185	5,365	400	3,893	7,782	7,656	7,253	21,252	24,438	11,220
41	Increase since drainage.....acres..		207		1,905	4,038	5,920	2,886	9,032	31,011	480
42	Per cent of increase.....		3.9		48.9	51.9	77.3	39.8	42.5	128.9	4.3
43	Per cent increase is of all improved land in farms, 1920.....		0.1		1.5	2.0	4.2	2.9	8.8	14.1	0.3
44	Timber and cut-over land, 1920.....acres..	6,555	690	11,018	4,282	8,114	3,533	8,700	41,790	35,011	9,600
45	Timber and cut-over land prior to drainage.....acres..	6,555	897	11,018	5,497	10,277	9,453	11,586	48,137	66,022	10,080
46	Decrease since drainage.....acres..		207		1,215	2,163	5,920	2,886	6,347	31,011	480
47	Per cent of decrease.....		23.1		22.1	21.0	62.6	24.9	13.2	47.0	4.8
48	Other unimproved land, 1920.....acres..				2,070				573		5,000
49	Other unimproved land prior to drainage.....acres..				2,760	1,875			3,258		5,000
50	Decrease since drainage.....acres..				690	1,875			2,685		
51	Per cent of decrease.....				25.0	100.0			82.4		
52	Swampy or subject to overflow, 1920.....acres..		6,262	5,709	4,009	1,000		6,878	1,023	35,011	2,500
53	Swampy or subject to overflow, prior to drainage.....acres..		6,262	11,418	12,150	2,875		18,844	38,610	66,022	19,389
54	Decrease since drainage.....acres..			5,709	8,141	1,875		11,966	37,587	31,011	16,880
55	Per cent of decrease.....			50.0	67.0	65.2		63.5	97.4	47.0	87.1
CAPITAL INVESTED AND COST PER ACRE.											
56	Total capital invested in and required for completion of operating enterprises.....dollars..	76,240	43,500	180,000	60,000	130,375	122,582	134,919	380,012	490,056	94,369
57	Capital invested in these enterprises to Dec. 31, 1910.....dollars..	61,040	43,500	95,000	60,000	73,375	122,582	134,919	150,012	490,056	45,369
58	Additional capital required to complete these enterprises.....dollars..	15,200		85,000		57,000			230,000		49,000
59	Average cost per acre when completed.....dollars..	8.72	6.95	15.76	4.94	6.54	7.16	7.16	5.23	5.42	3.59
60	Enterprises constructing open ditches only.....dollars..	76,240	43,500	180,000	60,000	20,375	122,582	134,919	57,312	490,056	30,000
61	Average cost per acre when completed.....dollars..	8.72	6.95	15.76	4.94	12.73	7.16	7.16	5.35	5.42	3.00
62	Enterprises constructing open ditches and levees.....dollars..					110,000			298,700		49,300
63	Average cost per acre when completed.....dollars..					6.00			5.07		4.11
64	Enterprises constructing open ditches and tile drains.....dollars..								24,000		15,000
65	Average cost per acre when completed.....dollars..								8.00		3.49
CROPS.											
66	Improved land in enterprises reporting—										
67	Cotton as principal crop on drained land.....acres..		5,572	400	5,798	11,820	5,686		11,857	55,449	11,700
68	Corn as principal crop on drained land.....acres..	2,185					7,890	10,144	18,427		

¹ When works under construction have been completed.

DRAINAGE—MISSISSIPPI.

13

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Tate.	Tippah.	Tunica.	Union.	Wash- ington.	Webster.	Yalo- busha.	Yazoo.	Other counties. ¹	
LAND AREA.											
1	Approximate land area of the county.....	acres..	259,000	285,440	267,520	263,680	462,720	266,240	313,600	579,200	1,279,360
2	All land in operating drainage enterprises.....	acres..	34,030	12,537	18,960	29,919	358,140	4,950	14,900	25,500	9,169
3	Improved land.....	acres..	15,721	9,036	3,161	15,805	198,909	2,618	6,720	14,100	4,172
4	Per cent of all improved land in farms.....		11.3	8.4	2.7	14.5	86.4	3.0	6.5	5.8	1.1
5	Timber and cut-over land.....	acres..	15,063	3,501	15,799	14,114	159,231	2,332	8,180	11,400	4,997
6	Other unimproved land.....	acres..	3,246								
7	Swampy or subject to overflow, in enterprises.....	acres..	4,006	700	65	890	44,961				1,200
8	Suffering loss of crops from defective drainage.....	acres..	608								
9	Assessed acreage.....	acres..	34,030	12,537	18,960	29,919	358,140	4,950	14,900	25,500	9,169
10	Excess over all land in operating enterprises.....	acres..									
DRAINAGE WORKS.											
11	Open ditches:										
12	Completed.....	miles..	47.2	57.0	6.6	72.6	292.7	10.0	14.6	5.4	28.4
13	Additional under construction.....	miles..	3.8		2.0		112.3		8.4		
14	Maximum completed in any enterprise.....	miles..	18.0	15.0	3.3	26.0	121.0	6.0	8.5	3.4	8.4
15	Maximum width at bottom of ditch ²	feet..	60	24	35	30	120	15	35	16	20
16	Maximum of average depths of outlet ditches ²	feet..	10.0	9.0	9.0	10.0	10.0	10.0	8.0	10.0	9.0
17	Mean depth of branch ditches ²	feet..		5.0	7.6		7.0		5.0	8.0	
18	Tile drains:										
19	Completed.....	miles..									
20	Additional under construction.....	miles..									
21	Maximum completed in any enterprise.....	miles..									
22	Maximum size of tile ²	inches..									
23	Accessory levees and dikes:										
24	Completed.....	miles..			2.7					0.4	
25	Additional under construction.....	miles..			3.8						
26	Pumping plants:										
27	Engine capacity.....	horsepower..					250				
28	Pump capacity.....	gallons per minute..					78,000				
29	Area served by pumps.....	acres..					44,000				
30	Area drained by open ditches only ²	acres..	34,030	12,537		29,919	358,140	4,950	14,900	13,000	9,169
31	Length of these ditches.....	miles..	51.0	57.0		72.6	405.0	10.0	23.0	2.0	28.4
32	Average length per acre.....	feet..	7.9	24.0		12.8	6.0	10.7	8.2	0.8	16.4
33	Area having open ditches and levees ²	acres..			18,960					12,500	
34	Length of these ditches.....	miles..			8.6					3.4	
35	Average length per acre.....	feet..			2.4					1.4	
36	Length of the accessory levees.....	miles..			6.5					0.4	
37	Area drained by open ditches and tile ²	acres..									
38	Length of these drains.....	miles..									
39	Average length per acre.....	feet..									
DEVELOPMENT OF LAND.											
40	Improved land in operating enterprises, 1920.....	acres..	15,721	9,036	3,161	15,805	198,909	2,618	6,720	14,100	4,172
41	Improved land prior to drainage.....	acres..	6,046	3,947	2,291	6,080	97,248	2,419	6,720	13,475	2,452
42	Increase since drainage.....	acres..	9,675	5,089	870	9,725	101,661	199		625	1,720
43	Per cent of increase.....		160.0	128.9	38.0	160.0	104.5	8.2		4.6	70.1
44	Per cent increase is of all improved land in farms, 1920.....		7.0	4.7	0.7	8.9	44.1	0.2		0.3	0.5
45	Timber and cut-over land, 1920.....	acres..	15,063	3,501	15,799	14,114	159,231	2,332	8,180	11,400	4,997
46	Timber and cut-over land prior to drainage.....	acres..	24,738	8,507	16,637	23,839	260,892	2,531	8,180	12,025	6,717
47	Decrease since drainage.....	acres..	9,675	5,006	838	9,725	101,661	199		625	1,720
48	Per cent of decrease.....		39.1	58.8	5.0	40.8	39.0	7.9		5.2	25.6
49	Other unimproved land, 1920.....	acres..	3,246								
50	Other unimproved land prior to drainage.....	acres..	3,246	83	32						
51	Decrease since drainage.....	acres..		83	32						
52	Per cent of decrease.....			100.0	100.0						
53	Swampy or subject to overflow, 1920.....	acres..	4,006	700	65	890	44,961				1,200
54	Swampy or subject to overflow, prior to drainage.....	acres..	20,030	1,010	903	1,616	158,618				5,350
55	Decrease since drainage.....	acres..	16,024	310	838	726	113,657				4,150
56	Per cent of decrease.....		80.0	30.7	92.8	44.9	71.7				77.6
CAPITAL INVESTED AND COST PER ACRE.											
57	Total capital invested in and required for completion of operating enterprises.....	dollars..	184,000	99,476	134,312	202,200	1,921,229	22,919	114,000	31,000	58,438
58	Capital invested in these enterprises to Dec. 31, 1919.....	dollars..	169,000	99,476	54,812	202,200	1,368,229	22,919	54,000	31,000	58,438
59	Additional capital required to complete these enterprises.....	dollars..	15,000		79,500		553,000		60,000		
60	Average cost per acre when completed.....	dollars..	5.41	7.93	7.08	6.76	5.36	4.63	7.65	1.22	6.37
61	Enterprises constructing open ditches only.....	dollars..	184,000	99,476		202,200	1,921,229	22,919	114,000	14,000	58,438
62	Average cost per acre when completed.....	dollars..	5.41	7.93		6.76	5.36	4.63	7.65	1.08	6.37
63	Enterprises constructing open ditches and levees.....	dollars..			134,312					17,000	
64	Average cost per acre when completed.....	dollars..			7.08					1.36	
65	Enterprises constructing open ditches and tile drains.....	dollars..									
66	Average cost per acre when completed.....	dollars..									
CROPS.											
67	Improved land in enterprises reporting—										
68	Cotton as principal crop on drained land.....	acres..	15,721		3,161		161,897	2,618	6,720	14,100	3,392
69	Corn as principal crop on drained land.....	acres..		9,036		15,805	37,012				780

¹ Includes only Leake, Montgomery, Tishomingo, and Winston Counties.² When works under construction have been completed.

DRAINAGE : MISSOURI

STATISTICS FOR THE STATE AND ITS COUNTIES

Prepared under the supervision of WILLIAM LANE AUSTIN, Chief Statistician for Agriculture, by ROGER D. MARSDEN, Special Agent in Charge of Drainage

CONTENTS.

	Page.		Page.
INTRODUCTION.....	1	DRAINAGE ENTERPRISES—Continued.	
MAP SHOWING OPERATING DRAINAGE ENTERPRISES.....	2	Size of enterprises.....	4
DRAINAGE ON FARMS.....	3	Character of enterprises.....	5
Explanation of terms.....	3	Drainage works.....	7
Farms and farm land.....	3	Maintenance of works.....	7
DRAINAGE ENTERPRISES.....	3	Date of organization.....	8
Explanation of terms.....	3	Crops.....	8
Operating and nonoperating enterprises.....	4	COUNTY TABLES:	
Location of enterprises.....	4	I.—Drainage on farms: 1920.....	9
Condition of land in enterprises.....	4	II.—Operating drainage enterprises: 1920.....	11

INTRODUCTION.

This bulletin presents the statistics of drainage for Missouri collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises include considerable areas of timbered and other unimproved land not yet

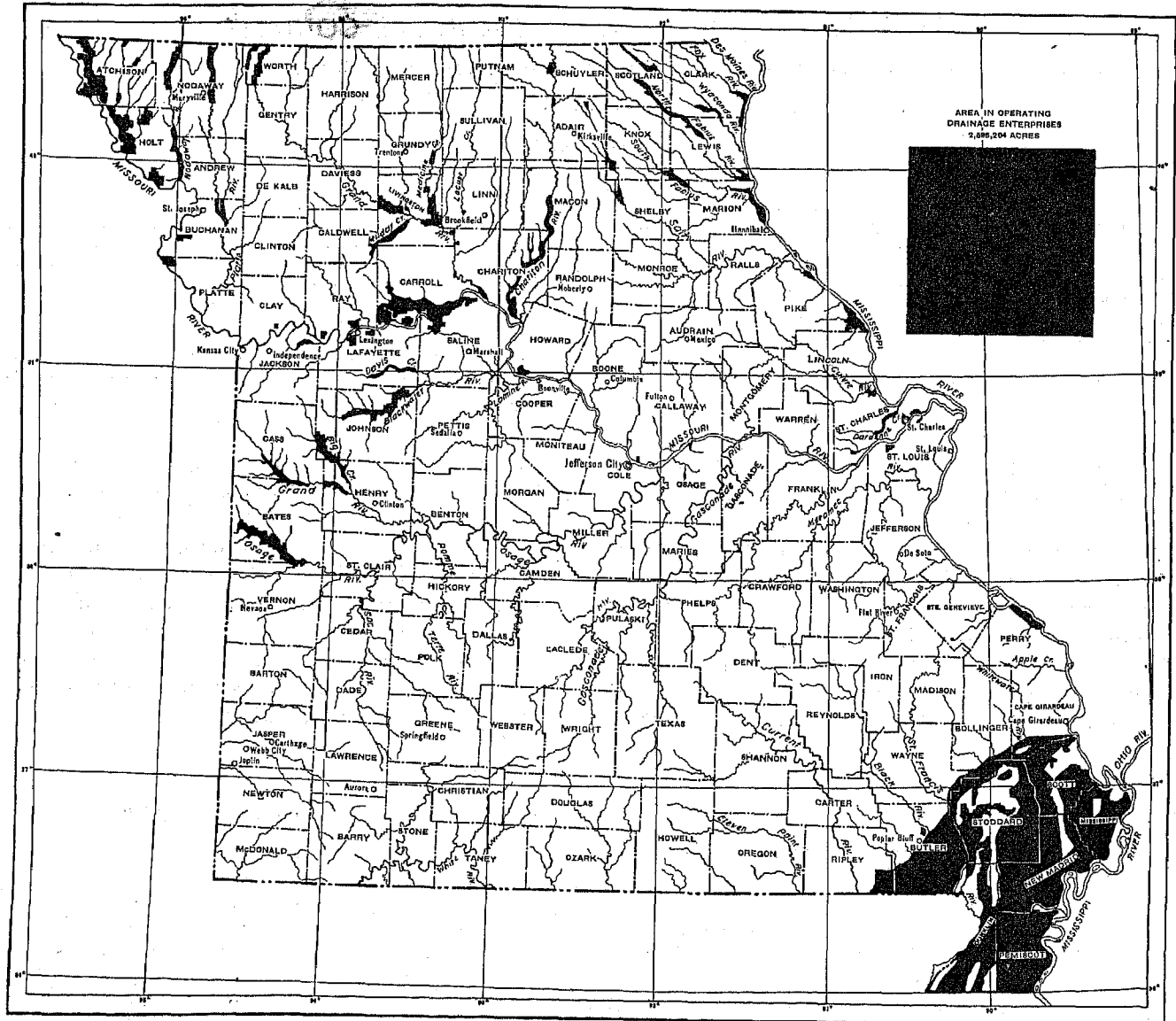
in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
DRAINAGE ON FARMS.		
Number of all farms in the state.....	263,004	100.0
Farms reporting land having drainage.....	11,917	4.5
Farms reporting land needing drainage.....	19,572	7.4
All land in farms.....acres..	34,774,679	100.0
Improved land in farms.....acres..	24,832,966	71.4
Farm land reported as provided with drainage.....acres..	859,663	2.5
Farm land reported as needing drainage.....acres..	830,693	2.4
DRAINAGE ENTERPRISES.		
Approximate land area of the state.....acres..	43,985,280	100.0
All land in operating drainage enterprises.....acres..	2,596,204	5.9
Improved land.....acres..	1,474,302	3.4
Timber and cut-over land.....acres..	1,074,860	2.4
Other unimproved land.....acres..	47,042	0.1
Capital invested in and required for completion of operating enterprises..	\$24,749,735	100.0
Capital invested in these enterprises to Dec. 31, 1919.....	\$20,723,128	83.7
Additional capital required to complete these enterprises.....	\$4,026,607	16.3

MISSOURI

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



DRAINAGE ON FARMS.

Explanation of terms.—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which are substantially as follows:

Drainage of agricultural land was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purpose of improving the condition of the soil and crops.

The area provided with drainage, in farms, is the acreage actually benefited or made of more value for agricultural purposes by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land not now suitable for crops which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators have answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual." Levee districts, however, generally are not included in the enterprises for which data are given in this bulletin (see definition of drainage enterprises, below).

Farms and farm land.—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for growing crops by reason of the drainage. This is to be distinguished from the area merely provided with outlet facilities by organized drainage enterprises. Drainage on farms represents in most cases the result of work done by the farm owner, either independently or supplemental to the work done by a drainage enterprise, but the acreage would include also any farm land receiving similar benefits directly from the works of an enterprise.

DRAINAGE ENTERPRISES.

Explanation of terms.—The more important terms used in connection with the census of drainage enterprises were defined as follows:

Drainage enterprises comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swamp or overflowed land for sale, other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditches or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise, though the capacities of drainage pumping plants are given only in the counties in which the plants are located.

Operating enterprises, as designated in this bulletin, are those that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

Land in drainage enterprises comprises the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises, deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (a) improved land; (b) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (c) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be considerably greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprises.

Timber and cut-over land includes farm woodland of natural or

planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, land subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering loss of crops is intended to include only land devoted to planted crops which suffer damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A pumping district is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also districts that had just been established by court decree and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. ¹		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	2,980,205	100.0	\$20,889,323	100.0	\$10,178,401
Operating enterprises.....	2,596,204	87.1	20,723,128	99.2	4,026,607
With works completed.....	1,858,945	62.4	13,294,035	63.6	.....
With works under construction.....	737,259	24.7	7,429,093	35.6	4,026,607
Nonoperating enterprises.....	384,061	12.9	166,200	0.8	6,151,794

¹The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919" and for an "estimate of additional investment to complete."

Location of enterprises.—Two-thirds of the area in drainage enterprises in Missouri is in the southeast corner of the state. Southeast of a line passing about 6 miles west of Cape Girardeau and Poplar Bluff, approximately 70 per cent of all the land is in drainage enterprises. This region, except Mississippi and Scott Counties and the east corner of New Madrid County, is drained southwesterly through Arkansas.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises...	2,980,205	100.0	\$20,889,323	100.0	\$10,178,401
Operating enterprises.....	2,596,204	87.1	20,723,128	99.2	4,026,607
Mississippi River.....	702,824	23.6	6,317,435	30.2	300,250
Black River.....	262,876	8.8	1,354,932	6.5	1,000,000
St. Francis River.....	1,173,030	39.4	9,313,035	44.6	2,089,317
Missouri River.....	367,151	12.3	2,550,493	12.2	373,805
Osage River.....	90,823	3.0	1,187,231	5.7	263,175
Nonoperating enterprises.....	384,061	12.9	166,200	0.8	6,151,794
Mississippi River.....	45,714	1.5	9,600	(1)	316,670
St. Francis River.....	48,835	1.6	8,600	(1)	428,369
Missouri River.....	289,512	9.7	148,000	0.7	5,406,755

¹Less than one-tenth of 1 per cent.

Almost all the other land in drainage enterprises is situated in the northwestern part of the state, some along Mississippi River and its smaller tributaries but more on the streams flowing into the Missouri.

Condition of land in enterprises.—In the southeastern part of Missouri, except as artificial drainage has been accomplished, the area in drainage enterprises is mostly typical southern swamp land which in its virgin state was covered generally with timber. Considerable protection against overflow from the Mississippi is afforded by levees along that river, but the natural drainage channels are extremely crooked and obstructed, and have high banks from which the land slopes away to wide swampy tracts.

In the northern and western parts of the state, the area in drainage enterprises is generally the bottom land between the hills, subject to inundation by stream floods. A considerably greater part was under some degree of cultivation before the drainage enterprises were organized than was the case in the southeastern counties.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms, and to afford relief from overflow for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	2,596,204	100.0	1,858,945	737,259	384,061
Improved land.....	1,474,302	56.8	1,207,730	266,572	205,003
Timber and cut-over land.....	1,074,860	41.4	610,296	464,564	77,268
Other unimproved land.....	47,042	1.8	40,919	6,123	41,730
Swampy or subject to overflow.....	454,360	17.5	200,972	253,388	270,382
Suffering a loss of crops.....	242,268	9.3	123,210	119,048	17,917

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way, 238 operating drainage enterprises are counted in Missouri, with an average area of 13,046 acres assessed. The assessed acreage exceeds the land in enterprises by 508,685 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed acreage, deduction was made for the amount of overlapping with enterprises organized previously, to determine the acreage to be tabulated as land in enterprises.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

AREA ASSESSED.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	2,596,204	3,104,880	100.0
Less than 200 acres.....	177	177	(¹)
200 to 499 acres.....	1,058	1,058	(¹)
500 to 999 acres.....	10,901	13,154	0.4
1,000 to 4,999 acres.....	217,559	239,414	7.7
5,000 to 9,999 acres.....	302,068	341,884	11.0
10,000 to 49,999 acres.....	1,306,271	1,557,027	50.2
50,000 to 99,999 acres.....	503,703	546,213	17.6
100,000 to 499,999 acres.....	254,377	405,062	13.0

¹ Less than one-tenth of 1 per cent.

Character of enterprises.—The drainage enterprises in Missouri are nearly all drainage districts established by the circuit courts and the county courts, in accordance with the general drainage laws of the state. The few other drainage enterprises include levee districts, county drains, and enterprises under individual ownership, including some in which two or more farm owners cooperated without organizing under any law. The statutes relating to the establishment of drains and levees have been amended many times, and now form chapter 41 of the Revised Statutes of Missouri, 1909.

Drainage districts may be established by the circuit courts for the reclamation of swamp, wet, or overflowed land for agricultural or sanitary purposes, under the provisions of Article I, of chapter 41 of the Revised Statutes. Levee districts may be established by the circuit courts for the reclamation and protection of land from overflow and other water, for agricultural or sanitary purposes, under Article IX of that chapter. Both of these articles were newly written and reenacted in 1913, Article I on March 24 and Article IX on April 7.

The circuit court drainage districts are formed, according to the existing statute, by the owners of a majority of the acreage signing and filing with the clerk of the circuit court articles of association containing a petition for the establishment of the district described therein. The district is declared a public corporation if the court, after public hearing, approves the petition. The officers of the district are five supervisors elected by the landowners voting in proportion to their acreages. The plan of reclamation works is determined by the supervisors. Damages and benefits are assessed by three commissioners appointed by the court. After public hearing upon the commissioners' report, the court may amend the assessments, subject to appeal, and must confirm the report or dissolve the district according to whether the benefits will be greater or less than the cost of reclamation. The supervisors construct the reclamation works of the district, by letting contracts or otherwise. They may issue bonds of the district for not exceeding 90 per cent of the taxes levied to pay the cost of the

enterprise, which is apportioned according to the benefits. For a district located in two or more counties, the articles of association are filed in the circuit court of the county containing the greater part of the district. The period of incorporation may be extended upon petition from the landowners.

Circuit court levee districts are organized in a manner similar to circuit court drainage districts. The duties and powers of the supervisors are like those of the supervisors of the drainage districts, but the provisions regarding levy of taxes and amount of bond issue are not identical.

The drainage districts established by the county courts now are governed by Articles III and IV of chapter 41, Revised Statutes of 1909, as amended. Article IV was entirely rewritten by an act of May 29, 1919. Levee districts may be established by the county courts in accordance with Article X of the same chapter.

Each drainage district organized under Article III is established by the county court of the county containing the greater part of the land in the proposed district, after receipt of a petition from the owners of a major part of the land or from a majority of the owners representing one-third or more of the land to be drained. The enterprise is administered by three commissioners appointed by the court, who investigate the practicability of the project and, if the benefits will exceed the cost, prepare plans for the improvement works. The commissioners assess damages, and apportion the cost against the tracts of land in proportion to the benefits that will accrue. The court holds hearings upon the petition and upon the commissioners' report, and may change the boundaries of the district, the awards of damages, and the assessments of benefits before confirming the report. The commissioners may issue notes or bonds of the district to secure funds for financing the undertaking.

The present form of Article IV provides that drainage districts may be established by the county courts upon petition from one or more interested landowners, whenever the proposed drainage will be of public benefit. The court appoints three viewers and an engineer to report upon the practicability and utility of the proposed undertaking, and may establish the district after public hearing upon this report. Then three viewers and an engineer again are appointed to prepare the complete plan of drainage and to assess damages and benefits against the land to be affected. These assessments are confirmed by the court, after public hearing, with such amendments as are deemed equitable. Appeals regarding damages awarded may be taken to the circuit court. The assessments of cost, apportioned like the assessments of benefits, are payable in such installments as the court may determine, and bonds may be issued by the court in an amount not exceeding the assessments of cost.

County drains may be established, under Article V of the chapter on drains and levees, without being incorporated as districts, by petition to the county court from a majority in interest of the resident owners of any body of swamp or overflowed land. If the court approves the petition, two commissioners are appointed to act with the county surveyor in examining the land to be drained, in preparing a plan of improvement, and in assessing the amounts of damages and of benefits. After confirmation of the commissioners' report, the court acts as the executive officer of the enterprise.

Levee districts may be organized by the county courts, according to Article X, to protect land subject to overflow by rivers, after notice published by the court or by any interested landholder. A board of three directors is appointed by the court to prepare plans for the necessary protection works, and to construct and maintain the works if the landowners vote to complete the undertaking. The cost of construction is apportioned according to benefits determined by the county assessor, subject to appeal to the county board of equalization. Right of way is secured by agreement with the owners of the land taken or by condemnation proceedings. The directors may issue notes or bonds of the district for money borrowed for district purposes. Extension of the district to include all land benefited may be made by the court upon petition from the directors and after public hearing.

No enterprises are reported as organized under Article II, VI, VII, or VIII. Article II provides for organizing into a drainage district any county owning swamp or overflowed land donated by the state for reclamation purposes. Upon petition from a majority of the taxpaying citizens, the county court shall declare the county established as a drainage district according to Article I, and shall perform the duties therein prescribed for the supervisors of the district. Construction work is to be put under contract, payable in the swamp and overflowed land of the county at not less than \$1.25 per acre. Articles VI and VII were repealed by an act of March 27, 1913, which provides for the drainage of wet or overflowed land by individuals without forming drainage districts. Owners of land that must be drained across the property of other owners may petition either the county court or the circuit court to appoint commissioners to consider the location of the necessary drain and to assess damages and benefits. After public hearing and confirmation of the commissioners' report, and after payment of damages has been made or offered, the court may let contract for construction of the drain or levee and charge the cost to the landowners in proportion to the benefits assessed. Article VIII provides for the organization of sanitary drainage districts lying partly within a city of 300,000 inhabitants or more, under the circuit courts.

When Congress, in 1850, had given the swamp and overflowed land to the states in which it was located, Missouri undertook to encourage the development of that land. In 1851 laws were enacted to provide for the reclamation and sale of the swamp land in 10 southeastern counties of the state, by commissioners designated by the legislature, and to grant the swamp and overflowed land elsewhere to the counties in which it was situated. In 1853 the swamp land in the southeastern counties was given to those counties for reclamation. A number of statutes were enacted to encourage the counties in developing the land that had been given to them. A department of land reclamation was created by an act of March 25, 1913, in charge of a land reclamation commissioner appointed by the governor of the state. The commissioner's duties include diffusing information regarding the benefits to be derived from drainage and giving assistance in formulating plans for drainage work.

An act of March 13, 1867, authorized the county courts to condemn land for drainage purposes, and provided that commissioners should be appointed to assess damages and benefits. This seems to have been the first drainage law of Missouri to apportion the cost according to benefits. The drainage of land upon petition from the landowners apparently first was provided by an act of March 3, 1869. The first law authorizing the establishing of drainage districts with corporate powers was that of April 26, 1879, providing for articles of association to be filed with the circuit court and for proceedings not unlike those under the present circuit court drainage act (Art. I, ch. 41, Rev. Stat. 1909). The incorporation of drainage districts by county courts was first authorized by an act of April 1, 1893.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acres.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	2,980,265	100.0	\$20,889,328	100.0	\$10,178,401
Operating enterprises.....	2,596,204	87.1	20,723,128	99.2	4,026,607
Circuit court districts.....	1,070,738	35.9	13,362,764	64.0	2,538,040
Art. I, ch. 41, Rev. Stat. 1909.	1,001,996	33.6	12,170,764	58.3	2,234,040
Art. IX, ch. 41, Rev. Stat.	68,742	2.3	1,192,000	5.7	304,000
County court districts.....	1,514,530	50.8	7,280,164	34.9	1,467,567
Art. III, ch. 41, Rev. Stat.	200,217	6.7	534,673	2.6	8,625
Art. IV, ch. 41, Rev. Stat.	1,312,265	44.0	6,751,491	32.3	1,453,942
Art. X, ch. 41, Rev. Stat.	2,048	0.1	4,000	(1)	5,000
County drains.....	1,040	(1)	1,500	(1)	.....
Art. V, ch. 41, Rev. Stat.	1,040	(1)	1,500	(1)	.....
Individual ownerships.....	9,896	0.3	68,700	0.3	21,000
Nonoperating enterprises.....	384,061	12.9	166,200	0.8	6,151,794
Circuit court districts.....	318,476	10.7	161,000	0.8	5,752,884
Art. I, ch. 41, Rev. Stat. 1909.	318,476	10.7	161,000	0.8	5,752,884
County court districts.....	62,085	2.1	3,200	(1)	365,410
Art. IV, ch. 41, Rev. Stat.	62,085	2.1	3,200	(1)	365,410
Individual ownerships.....	8,600	0.1	2,000	(1)	33,500

¹ Less than one-tenth of 1 per cent.

Drainage works.—The total works completed by the drainage enterprises to December 31, 1919, comprised 3,438.7 miles of open ditches, 38.8 miles of tile drains, and 456.9 miles of accessory levees; the additional lengths under construction were 460.4 miles of open ditches, 5.9 miles of tile drains, and 74.9 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains.

There are 11 pumping districts among the operating drainage enterprises in Missouri, and 4 among the non-operating enterprises.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	2,596,204	100.0	\$20,723,128	100.0	\$4,026,607
Open ditches only.....	1,612,085	62.1	11,468,524	55.3	1,974,142
Open ditches and levees.....	883,432	34.0	7,276,025	35.1	1,939,040
Tile drains only.....	760	(1)	11,250	0.1	6,250
Open ditches and tile drains.....	46,240	1.8	466,230	2.2	19,000
Tile drains and levees.....	7,000	0.3	14,000	0.1	.....
Open ditches, tile drains, and levees.....	46,687	1.8	1,487,099	7.2	88,175

¹ Less than one-tenth of 1 per cent.

TABLE 8.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY TYPE OF DRAINAGE: 1920.

TYPE OF DRAINAGE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	2,596,204	100.0	\$20,723,128	100.0	\$4,026,607
Gravity drainage only.....	2,518,898	97.0	18,462,298	89.1	4,006,607
All drainage by pumping.....	77,306	3.0	2,260,830	10.9	20,000
Part gravity and part pumping.....	70,308	2.7	.....	.....	.....

TABLE 9.—DRAINAGE PUMPING PLANTS IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF POWER: 1920.

KIND OF POWER.	ENGINE CAPACITY.		PUMP CAPACITY.		AREA SERVED.	
	Horse-power.	Per cent of total.	Gallons per minute.	Per cent of total.	Acreage.	Per cent of total.
All enterprises.....	2,785	100.0	552,000	100.0	70,308	100.0
Steam.....	1,910	68.6	407,000	73.7	57,298	81.5
Electric.....	500	18.0	75,000	13.6	4,010	5.7
Internal-combustion.....	375	13.5	70,000	12.7	9,000	12.8

TABLE 10.—DRAINAGE PUMPING PLANTS IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF PUMPS: 1920.

KIND OF PUMP.	PUMPS.			ENGINE CAPACITY.		AREA SERVED.	
	Number.	Gallons per minute.	Per cent of total.	Horse-power.	Per cent of total.	Acreage.	Per cent of total.
All enterprises.....	14	552,000	100.0	2,785	100.0	70,308	100.0
Centrifugal.....	13	545,000	98.7	2,725	97.8	69,308	98.6
Rotary.....	1	7,000	1.3	60	2.2	1,000	1.4

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet and those 10 feet and more were omitted, because it seemed they did not represent so well the average depth of outlet provided for all the farms in those districts; to include these groups, computed as 3 feet and 10 feet, respectively, would make the mean depth for the state 7.2 instead of 7.0 feet.

TABLE 11.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	2,596,204	100.0
Less than 3 feet.....	29,617	1.1
3.0 to 3.9 feet.....	40,432	1.6
4.0 to 4.9 feet.....	111,656	4.3
5.0 to 5.9 feet.....	150,483	5.8
6.0 to 6.9 feet.....	163,866	6.3
7.0 to 7.9 feet.....	544,976	21.0
8.0 to 8.9 feet.....	827,407	31.9
9.0 to 9.9 feet.....	68,121	2.6
10 feet and more.....	203,195	7.8
Not reporting branches.....	456,431	17.6

Maintenance of works.—The circuit court drainage act (Art. I, ch. 41, Rev. Stat. 1909) and the circuit court levee act (Art. IX) authorize the boards of supervisors of the districts to maintain the improvement works of their respective districts in good condition, and to appoint ditch overseers or inspectors to

have charge of that work. Each board is authorized also to levy annually a tax for maintenance purposes, to be apportioned like and not to exceed 10 per cent of the net assessments of benefits for construction. The commissioners of drainage districts organized under Article III of the statutes relating to drains and levees are authorized to make repairs to the improvement works and to levy assessments therefor. However, if the cost will exceed the equivalent of 30 cents per acre on all the land benefited, the commissioners must file petition and the county court, after public hearing, determines what work shall be done and the amount of benefits to be assessed against each tract of land. Article IV directs that the county court appoint annually a ditch overseer to inspect and to keep in repair all ditches in the county established under this article. For the cost of maintenance the court may levy annually a tax not exceeding 10 per cent of the cost of construction, to be apportioned like the assessments of benefits for construction. Drains established under Article V are to be kept in repair by the county court, the cost to be paid by the land benefited in such proportion and in such manner as the court may prescribe.

TABLE 12.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	2,596,204	100.0	\$20,723,128	100.0	\$4,026,607
By district forces.....	1,155,656	44.5	9,556,320	46.1	153,500
By contract.....	383,522	14.8	3,791,283	18.3	192,500
By landowners.....	254,539	9.8	1,692,916	8.2	49,000
By method not specified.....	142,831	5.5	1,423,256	6.9	57,025
No maintenance provided.....	165,584	6.4	802,364	3.9	594,150
Not reported.....	494,072	19.0	3,454,990	16.7	2,988,832

Date of organization.—The progress of development in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the courts, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of reclamation was completed.

TABLE 13.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	2,596,204	100.0	3,104,889	100.0
1880 to 1889.....	1,040	(1)	1,040	(1)
1890 to 1899.....	209,889	8.1	212,829	6.9
1900 to 1904.....	348,941	13.4	400,221	12.9
1905 to 1909.....	1,168,447	44.8	1,354,072	43.6
1910 to 1914.....	706,508	27.2	985,848	30.1
1915 to 1919.....	159,643	6.1	194,143	6.3
Not reported.....	6,736	0.3	6,736	0.2

¹ Less than one-tenth of 1 per cent.

TABLE 14.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$20,723,128	100.0	\$4,026,607
1880 to 1889.....	1,500	(1)	.....
1890 to 1899.....	592,995	2.9	.....
1900 to 1904.....	1,875,095	9.0	235,710
1905 to 1909.....	10,063,182	48.6	641,330
1910 to 1914.....	6,829,206	33.0	2,139,427
1915 to 1919.....	1,313,150	6.3	989,090
Not reported.....	48,000	0.2	21,090

¹ Less than one-tenth of 1 per cent.

TABLE 15.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	3,899.1	100.0	44.7	100.0	531.8	100.0
1880 to 1889.....	5.0	0.1	.....	.....	.....	.....
1890 to 1899.....	245.5	6.3	.....	.....	13.8	2.6
1900 to 1904.....	441.8	11.3	10.0	22.4	40.3	7.6
1905 to 1909.....	1,633.4	41.9	.....	.....	191.7	36.0
1910 to 1914.....	1,186.7	30.4	24.3	54.4	217.4	40.9
1915 to 1919.....	366.7	9.4	7.4	16.6	55.9	10.5
Not reported.....	20.0	0.5	8.0	6.7	12.7	2.4

Crops.—The principal crops grown upon the drained land in drainage enterprises are corn, cotton, and wheat. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE—MISSOURI.

9

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Adair.	Andrew.	Atchi- son.	Audrain.	Barton.	Bates.	Benton.	Bollin- ger.
1	Number of all farms in the state or county.....	263,004	2,453	2,334	1,541	2,521	2,362	3,500	2,157	2,220
2	Farms reporting land having drainage.....	11,917	53	135	350	21	04	193	13	32
3	Farms reporting land needing drainage.....	19,572	154	82	115	120	125	193	47	191
4	Farms in drainage and levee districts.....	7,743	6	2	194	11	2	105	.....	13
LAND AND FARM AREA.										
5	Approximate land area of the state or county.....acres..	43,985,280	365,440	273,920	337,920	438,400	381,440	556,800	476,800	389,700
6	All land in farms.....acres..	34,774,679	326,387	258,973	308,224	418,834	334,647	510,067	368,029	289,879
7	Improved land in farms.....acres..	24,832,966	265,708	215,006	287,910	381,502	304,550	443,245	199,021	155,334
8	Woodland in farms.....acres..	8,558,857	51,765	33,136	15,235	30,990	20,774	43,326	145,196	130,775
9	Other unimproved land in farms.....acres..	1,887,856	8,914	10,231	5,079	6,252	9,323	23,496	23,812	3,770
10	Farm land reported as provided with drainage.....acres..	850,663	3,134	3,769	31,397	1,496	1,645	10,262	795	1,044
11	Farm land reported as needing drainage.....acres..	380,693	5,192	1,010	6,271	3,287	2,688	8,652	1,581	5,868
12	Drainage only.....acres..	163,178	541	1,058	5,033	140	381	2,252	15	383
13	Drainage and clearing.....acres..	667,515	4,651	852	1,238	3,147	2,307	6,400	1,566	5,485

		Boone.	Buch- anan.	Butler.	Caldwell.	Callaway.	Camden.	Cape Gi- rardeau.	Carroll.	Cass.
1	Number of all farms in the county.....	3,325	2,627	2,105	1,963	3,284	1,739	2,661	3,077	3,036
2	Farms reporting land having drainage.....	10	100	154	75	11	11	141	383	148
3	Farms reporting land needing drainage.....	205	104	669	61	66	134	186	75	278
4	Farms in drainage and levee districts.....	4	10	426	30	2	1	76	247	59
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	440,320	261,120	447,360	277,120	517,120	429,680	371,200	449,920	461,440
6	All land in farms.....acres..	404,637	238,542	209,340	264,513	476,351	309,482	340,968	413,347	417,564
7	Improved land in farms.....acres..	327,301	186,407	105,269	241,278	344,458	103,789	230,275	379,405	357,638
8	Woodland in farms.....acres..	61,385	37,741	96,741	18,012	113,550	197,546	105,304	24,395	40,951
9	Other unimproved land in farms.....acres..	16,961	14,394	17,390	5,223	15,834	8,147	5,389	9,457	19,075
10	Farm land reported as provided with drainage.....acres..	1,260	2,956	6,545	2,364	663	579	21,690	40,842	5,168
11	Farm land reported as needing drainage.....acres..	4,089	2,719	36,933	1,380	1,911	5,263	11,144	5,453	9,598
12	Drainage only.....acres..	100	972	4,899	176	231	122	2,415	2,627	2,617
13	Drainage and clearing.....acres..	4,889	1,747	32,034	1,204	1,680	5,141	8,729	2,826	6,981

		Cedar.	Chariton.	Clark.	Clay.	Clinton.	Cole.	Cooper.	Davies.	Dunklin.
1	Number of all farms in the county.....	2,448	3,426	1,008	1,973	1,576	1,621	2,419	2,731	3,033
2	Farms reporting land having drainage.....	126	138	156	21	73	25	46	60	920
3	Farms reporting land needing drainage.....	208	146	102	99	71	98	52	246	519
4	Farms in drainage and levee districts.....	2	42	144	18	.....	.....	3	9	972
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	318,720	491,520	318,720	257,280	270,720	248,960	357,120	360,960	339,200
6	All land in farms.....acres..	284,142	445,102	290,472	236,581	255,448	232,481	331,099	345,189	186,900
7	Improved land in farms.....acres..	199,830	386,055	216,622	201,678	233,944	140,846	272,382	272,171	160,094
8	Woodland in farms.....acres..	68,790	46,103	43,849	25,772	16,922	79,878	51,080	45,213	24,187
9	Other unimproved land in farms.....acres..	16,472	12,944	30,501	9,131	4,582	11,757	7,737	27,805	2,619
10	Farm land reported as provided with drainage.....acres..	2,697	17,721	15,599	2,029	3,462	1,745	1,267	1,840	41,682
11	Farm land reported as needing drainage.....acres..	4,731	5,551	4,075	2,163	1,478	2,462	1,345	7,982	17,768
12	Drainage only.....acres..	2,043	2,252	2,238	102	1,183	129	948	2,697	3,581
13	Drainage and clearing.....acres..	2,688	3,329	1,837	2,061	295	2,333	397	5,285	14,187

		Gascon- ade.	Gentry.	Grundy.	Harris- son.	Henry.	Holt.	Howard.	Jackson.	Jasper.
1	Number of all farms in the county.....	1,768	2,269	1,915	3,135	3,098	1,814	1,698	3,345	2,786
2	Farms reporting land having drainage.....	20	22	32	19	98	172	45	189	77
3	Farms reporting land needing drainage.....	451	63	163	184	160	57	23	71	100
4	Farms in drainage and levee districts.....	2	1	13	7	66	168	6	23	1
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	328,960	313,000	277,120	461,440	476,160	285,440	299,520	390,400	406,400
6	All land in farms.....acres..	300,700	302,056	271,495	438,184	432,719	253,653	265,679	312,321	328,793
7	Improved land in farms.....acres..	129,672	256,195	217,478	372,930	371,637	226,937	202,581	257,122	260,493
8	Woodland in farms.....acres..	159,707	32,778	38,788	46,599	47,921	17,243	53,834	39,848	36,992
9	Other unimproved land in farms.....acres..	11,231	13,083	15,220	18,655	13,161	9,473	9,264	15,351	31,308
10	Farm land reported as provided with drainage.....acres..	506	875	4,572	1,890	4,867	18,811	2,827	9,836	1,939
11	Farm land reported as needing drainage.....acres..	13,164	1,378	10,142	8,578	7,320	3,004	370	1,817	2,251
12	Drainage only.....acres..	112	505	5,266	4,327	2,599	1,930	148	592	372
13	Drainage and clearing.....acres..	13,052	873	4,876	4,251	4,721	1,074	222	1,315	1,879

DRAINAGE—MISSOURI.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Johnson.	Knox.	Lafayette.	Lewis.	Lincoln.	Linn.	Livingston.	Macon.	Marion.	
1	Number of all farms in the county.....	3,590	1,880	2,807	1,878	2,540	2,513	2,316	3,750	1,623	
2	Farms reporting land having drainage.....	82	32	592	61	73	52	97	60	65	
3	Farms reporting land needing drainage.....	36	86	201	232	148	319	46	460	92	
4	Farms in drainage and levee districts.....	69	20	27	31	33	14	57	29	34	
LAND AND FARM AREA.											
5	Approximate land area of the county.....acres..	531,840	323,060	391,680	322,560	388,480	400,040	339,840	517,760	279,040	
6	All land in farms.....acres..	496,643	302,841	357,077	305,155	343,700	330,560	304,474	480,514	240,184	
7	Improved land in farms.....acres..	437,752	262,247	324,038	243,210	255,015	324,804	253,365	403,868	190,457	
8	Woodland in farms.....acres..	45,990	33,054	23,636	51,342	77,866	42,871	36,772	67,704	38,076	
9	Other unimproved land in farms.....acres..	12,901	7,540	9,403	10,603	10,819	12,825	14,337	8,942	17,631	
10	Farm land reported as provided with drainage.....acres..	5,493	2,030	35,864	6,645	10,351	4,749	6,719	3,504	8,898	
11	Farm land reported as needing drainage.....acres..	1,631	2,538	10,989	6,942	7,192	13,145	3,793	18,603	8,994	
12	Drainage only.....acres..	248	820	8,702	424	1,948	5,557	2,708	3,479	3,817	
13	Drainage and clearing.....acres..	1,383	2,218	2,287	6,518	5,244	7,588	1,025	15,124	3,177	
		Miller.	Mississippi.	Morgan.	New Madrid.	Nodaway.	Osage.	Pemiscot.	Perry.	Pettis.	
1	Number of all farms in the county.....	2,194	1,184	1,858	2,052	3,657	1,979	2,533	1,972	2,797	
2	Farms reporting land having drainage.....	38	434	23	579	488	15	911	41	196	
3	Farms reporting land needing drainage.....	152	134	157	711	266	65	309	309	45	
4	Farms in drainage and levee districts.....	1	455	1	933	116	10	945	68	1	
LAND AND FARM AREA.											
5	Approximate land area of the county.....acres..	379,520	264,320	302,960	417,280	557,440	379,520	291,840	205,680	438,400	
6	All land in farms.....acres..	336,663	187,260	272,692	243,303	546,068	319,060	132,574	264,228	409,041	
7	Improved land in farms.....acres..	164,258	156,279	154,520	195,362	502,089	159,648	118,359	163,900	345,897	
8	Woodland in farms.....acres..	162,067	16,430	108,317	41,667	31,270	154,138	10,480	91,086	49,664	
9	Other unimproved land in farms.....acres..	10,338	14,557	9,855	6,274	11,809	35,274	3,726	8,633	13,480	
10	Farm land reported as provided with drainage.....acres..	708	56,640	649	51,618	23,683	569	39,749	1,788	22,088	
11	Farm land reported as needing drainage.....acres..	4,320	11,488	5,397	58,535	9,725	2,104	14,181	9,091	2,530	
12	Drainage only.....acres..	266	2,279	256	27,801	6,043	400	7,488	773	1,195	
13	Drainage and clearing.....acres..	4,064	9,207	5,141	30,734	3,682	1,704	6,693	8,318	1,335	
		Pike.	Platte.	Putnam.	Randolph.	Ray.	Ripley.	St. Charles.	St. Clair.	St. Francois.	St. Louis.
1	Number of all farms in the county.....	2,681	2,021	2,153	2,380	2,541	1,638	2,165	2,049	1,266	3,735
2	Farms reporting land having drainage.....	93	152	44	60	204	125	159	47	3	137
3	Farms reporting land needing drainage.....	147	125	69	176	50	382	336	255	84	66
4	Farms in drainage and levee districts.....	48	11	.....	9	67	149	56	.....	.....	7
LAND AND FARM AREA.											
5	Approximate land area of the county.....acres..	417,920	265,600	330,880	314,240	361,600	401,280	342,400	451,840	293,120	311,680
6	All land in farms.....acres..	385,501	247,449	312,978	286,546	364,684	186,726	308,424	378,878	182,974	220,595
7	Improved land in farms.....acres..	294,004	187,222	259,820	231,089	264,170	87,978	229,965	242,853	99,076	177,487
8	Woodland in farms.....acres..	73,246	53,650	41,231	44,846	28,054	94,906	63,539	114,885	75,711	40,952
9	Other unimproved land in farms.....acres..	18,251	6,577	11,927	9,711	12,460	3,842	14,920	21,140	7,287	8,150
10	Farm land reported as provided with drainage.....acres..	8,394	3,882	1,559	2,785	12,971	2,753	21,635	1,234	1,544	6,328
11	Farm land reported as needing drainage.....acres..	10,839	3,140	2,184	4,848	1,056	16,124	8,567	9,712	1,893	1,206
12	Drainage only.....acres..	2,463	1,688	183	1,502	591	409	2,496	2,137	29	624
13	Drainage and clearing.....acres..	8,376	1,552	2,001	3,346	1,065	15,715	6,071	7,575	1,864	582
		Saline.	Scotland.	Scott.	Shelby.	Stoddard.	Sullivan.	Vernon.	Webster.	Worth.	All other counties. ¹
1	Number of all farms in the county.....	3,024	1,800	1,432	2,195	3,685	2,660	3,267	2,697	1,215	88,704
2	Farms reporting land having drainage.....	583	97	648	49	899	49	177	24	50	307
3	Farms reporting land needing drainage.....	275	80	186	23	716	103	272	256	55	6,630
4	Farms in drainage and levee districts.....	54	90	580	37	1,039	15	4	.....	0	44
LAND AND FARM AREA.											
5	Approximate land area of the county.....acres..	482,560	280,960	268,160	325,760	521,600	415,360	536,960	374,400	169,600	17,113,600
6	All land in farms.....acres..	424,702	268,843	202,403	301,155	347,974	388,429	464,069	314,505	162,744	11,717,679
7	Improved land in farms.....acres..	368,505	231,115	174,634	261,434	267,405	340,483	397,497	201,737	144,165	6,806,467
8	Woodland in farms.....acres..	35,940	30,050	24,924	34,823	72,728	34,028	52,212	104,561	13,345	4,406,262
9	Other unimproved land in farms.....acres..	20,257	7,678	2,845	4,898	7,841	13,918	14,360	8,207	5,234	505,920
10	Farm land reported as provided with drainage.....acres..	58,173	4,661	80,629	2,805	80,250	2,745	7,190	1,459	1,514	7,633
11	Farm land reported as needing drainage.....acres..	8,947	4,014	11,394	1,183	38,499	4,375	9,219	9,518	2,569	281,162
12	Drainage only.....acres..	4,669	854	1,961	745	1,885	3,601	1,750	4	1,150	5,877
13	Drainage and clearing.....acres..	4,278	3,160	9,433	438	36,614	774	7,469	9,514	1,419	275,285

¹ No drainage reported in Carter, Douglas, McDonald, Ozark, Stone, or Wright Counties.

DRAINAGE—MISSOURI.

11

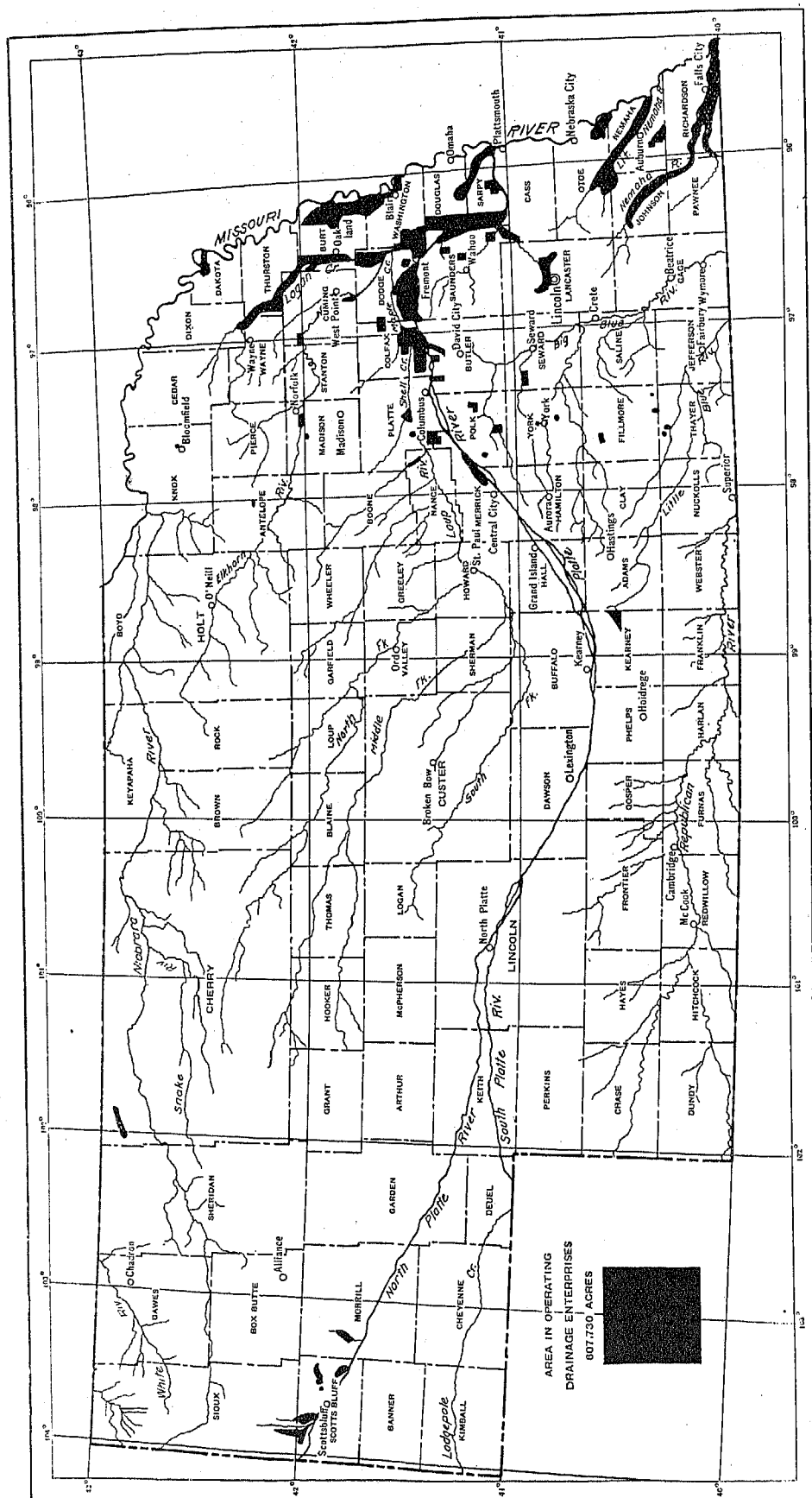
COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Adair.	Atchison.	Bates.	Bollinger.	Butler.	Cape Girardeau.	Carroll.	
LAND AREA.										
1	Approximate land area of the state or county	acres..	43,985,280	365,440	337,920	556,800	389,760	447,360	371,200	449,920
2	All land in operating drainage enterprises	acres..	2,596,204	8,800	46,982	49,626	33,765	232,800	37,236	52,224
3	Improved land	acres..	1,474,302	7,200	43,364	24,813	1,712	63,800	23,477	45,038
4	Per cent of all improved land in farms	5.9	2.7	15.1	5.6	1.1	60.6	10.2	11.9	11.9
5	Timber and cut-over land	acres..	1,074,800	1,000	98	11,808	32,053	169,000	13,759	2,184
6	Other unimproved land	acres..	47,042	600	3,520	13,005				5,002
7	Swampy or subject to overflow, in enterprises	acres..	454,360		10,987	6,276	31,621	103,700	1,151	
8	Suffering a loss of crops from defective drainage	acres..	242,258	525	9,444	1,046	1,284	36,210		225
9	Assessed acreage	acres..	3,104,889	8,800	46,982	49,626	33,765	232,800	37,236	72,464
10	Excess over all land in operating enterprises	acres..	508,685							20,240
DRAINAGE WORKS.										
11	Open ditches:									
12	Completed	miles..	3,438.7	12.3	103.8	39.5	9.4	177.4	71.9	78.6
13	Additional under construction	miles..	460.4	4.7	8.4	5.3		168.4		
14	Maximum completed in any enterprise	miles..	179.3	10.0	45.0	33.5	9.4	90.0	71.9	42.0
15	Maximum width at bottom of ditch ¹	feet..	125	20	30	60	80	55	11	60
16	Maximum of average depths of outlet ditches ¹	feet..	22.0	14.0	11.4	16.0	17.0	10.0	14.0	15.0
17	Mean depth of branch ditches ¹	feet..	7.0		6.4	8.0		7.5	8.0	7.8
18	Tile drains:									
19	Completed	miles..	38.8							6.1
20	Additional under construction	miles..	5.9							2.9
21	Maximum completed in any enterprise	miles..	15.0							3.0
22	Maximum size of tile ¹	inches..	30							18
23	Accessory levees and dikes:									
24	Completed	miles..	456.9	8.2			11.6	49.9	84.6	10.3
25	Additional under construction	miles..	74.9	4.5				26.6		2.1
26	Pumping plants:									
27	Engine capacity	horsepower..	2,785		125					
28	Pump capacity	gallons per minute..	552,000		30,000					
29	Area served by pumps	acres..	70,308		3,000					
30	Area drained by open ditches only ¹	acres..	1,612,085	8,800	5,587	49,626		25,800		9,800
31	Length of these ditches	miles..	2,480.3	17.0	19.8	44.8		47.8		31.6
32	Average length per acre	feet..	8.1	10.2	18.7	4.8		9.8		17.0
33	Area having open ditches and levees ¹	acres..	883,432		41,395		33,765	207,060	37,236	2,908
34	Length of these ditches	miles..	1,278.3		90.4		9.4	298.0	71.9	4.5
35	Average length per acre	feet..	7.6		11.5		1.5	7.6	10.2	8.2
36	Length of these accessory levees	miles..	481.7		12.7		11.6	76.5	34.6	5.2
37	Area drained by tile only ¹	acres..	760							
38	Length of these tile	miles..	4.0							
39	Average length per acre	feet..	27.8							
40	Area drained by open ditches and tile ¹	acres..	46,240							31,680
41	Length of these drains	miles..	88.9							45.0
42	Average length per acre	feet..	10.2							7.5
43	Area having tile and levees ¹	acres..	7,000							7,000
44	Length of these tile	miles..	3.0							3.0
45	Average length per acre	feet..	2.3							2.3
46	Length of these accessory levees	miles..	2.5							2.5
47	Area having open ditches, tile, and levees ¹	acres..	46,687							836
48	Length of these drains	miles..	89.3							3.5
49	Average length per acre	feet..	10.1							22.1
50	Length of these accessory levees	miles..	47.6							4.7
DEVELOPMENT OF LAND.										
51	Improved land in operating enterprises, 1920	acres..	1,474,302	7,200	43,364	24,813	1,712	63,800	23,477	45,038
52	Improved land prior to drainage	acres..	760,796	2,300	36,081	3,138	1,688	39,200	1,862	34,356
53	Increase since drainage	acres..	713,506	4,900	7,283	21,675	24	24,600	21,615	10,682
54	Per cent of increase ²	21.0	21.0	20.2	690.7	1.4		62.8		31.1
55	Per cent increase is of all improved land in farms, 1920	2.9	1.8	2.5	4.9	(3)	23.4	9.4		2.8
56	Timber and cut-over land, 1920	acres..	1,074,800	1,000	98	11,808	32,053	169,000	13,759	2,184
57	Timber and cut-over land prior to drainage	acres..	1,040,207	3,800	1,418	11,808	32,077	193,000	35,374	5,156
58	Decrease since drainage	acres..	571,437	2,800	1,320		24	24,000	21,615	5,072
59	Per cent of decrease	53.1	73.7	93.1			0.1	12.7	61.1	73.2
60	Other unimproved land, 1920	acres..	47,042	600	3,520	13,005				5,002
61	Other unimproved land prior to drainage	acres..	189,111	2,700	9,483	34,680				9,712
62	Decrease since drainage	acres..	142,069	2,100	5,963	21,675				4,710
63	Per cent of decrease	75.1	77.8	62.9	62.5					48.5
64	Swampy or subject to overflow, 1920	acres..	454,360		10,987	6,276	31,621	103,700	1,151	
65	Swampy or subject to overflow, prior to drainage	acres..	2,013,704	2,100	27,099	49,626	32,077	211,940	35,374	25,006
66	Decrease since drainage	acres..	1,559,344	2,100	16,112	43,350	456	108,240	34,223	25,006
67	Per cent of decrease	77.4	100.0	59.5	87.4	1.4	51.1	51.1	96.7	100.0
CAPITAL INVESTED AND COST PER ACRE.										
68	Total capital invested in and required for completion of operating enterprises	dollars..	24,749,735	70,328	512,988	700,108	5,000	2,264,672	374,000	348,700
69	Capital invested in these enterprises to Dec. 31, 1919	dollars..	20,723,128	53,328	386,748	626,797	5,000	1,264,672	374,000	328,700
70	Additional capital required to complete these enterprises	dollars..	4,026,607	17,000	126,240	74,311		1,000,000		20,000
71	Average cost per acre when completed	dollars..	9.53	7.99	10.92	14.11	0.15	9.73	10.04	6.68
72	Enterprises constructing open ditches only	dollars..	13,442,666	70,328	55,488	700,108		117,672		54,000
73	Average cost per acre when completed	dollars..	8.34	7.99	9.93	14.11		4.56		5.51
74	Enterprises constructing open ditches and levees	dollars..	9,215,065		457,500		5,000	2,147,000	374,000	10,700
75	Average cost per acre when completed	dollars..	10.43		11.05		0.15	10.37	10.04	3.68
76	Enterprises constructing tile drains only	dollars..	17,500							
77	Average cost per acre when completed	dollars..	23.03							
78	Enterprises constructing open ditches and tile drains	dollars..	485,230							230,000
79	Average cost per acre when completed	dollars..	10.49							7.26
80	Enterprises constructing tile drains and levees	dollars..	14,000							14,000
81	Average cost per acre when completed	dollars..	2.00							2.00
82	Enterprises constructing open ditches, tile drains, and levees	dollars..	1,575,274							40,000
	Average cost per acre when completed	dollars..	33.74							47.85
CROPS.										
83	Improved land in enterprises reporting—									
84	Corn as principal crop on drained land	acres..	980,387	7,200	43,364	24,813	1,712	63,800	23,477	31,540
85	Cotton as principal crop on drained land	acres..	250,681							
86	Wheat as principal crop on drained land	acres..	243,234							13,498

¹ When works under construction have been completed.² Per cent not shown when more than 1,000.³ Less than one-tenth of 1 per cent.

NEBRASKA

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



DRAINAGE—MISSOURI.

13

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Lafayette.	Lewis.	Lincoln.	Livingston.	Macon.	Marion.	Mississippi.	New Madrid.	Nodaway.
LAND AREA.										
1	Approximate land area of the county.....acres	391,680	322,560	388,480	339,840	517,760	279,040	264,320	417,280	557,440
2	All land in operating drainage enterprises.....acres	12,079	16,125	16,800	48,207	17,244	23,794	204,845	371,287	16,208
3	Improved land.....acres	10,871	14,040	16,050	39,165	8,622	20,084	130,575	190,039	14,624
4	Per cent of all improved land in farms.....	3.4	5.8	6.3	15.5	2.1	10.5	83.0	97.3	2.9
5	Timber and cut-over land.....acres	1,208	1,747	750	9,042	1,724	2,052	73,314	181,248	1,584
6	Other unimproved land.....acres		338			6,898	1,658	956		
7	Swampy or subject to overflow, in enterprises.....acres	381	172	750	27,243	1,724		35,275	57,169	36
8	Suffering a loss of crops from defective drainage.....acres		453		5,323	80	1,480	31,846	20,512	208
9	Assessed acreage.....	12,079	16,125	16,800	48,207	17,244	23,794	338,235	650,953	16,208
10	Excess over all land in operating enterprises.....acres							133,390	279,666	
DRAINAGE WORKS.										
11	Open ditches:									
12	Completed.....miles	23.1	32.7	29.2	74.7	19.0	17.7	210.5	698.6	36.2
13	Additional under construction.....miles							23.3	27.2	
14	Maximum completed in any enterprise.....miles	9.5	10.0	19.2	14.1	19.0	7.5	55.0	120.5	17.0
15	Maximum width at bottom of ditch ¹.....feet	8	75	30	25	125	40	45	122	60
16	Maximum of average depths of outlet ditches ¹.....feet	8.0	14.0	18.0	12.0	22.0	11.0	16.0	12.0	13.0
17	Mean depth of branch ditches ¹.....feet	3.0	7.0	3.9	3.6	8.0	5.5	8.1	6.4	4.0
18	Tile drains:									
19	Completed.....miles		1.3				26.9	2.8		
20	Additional under construction.....miles							1.7		
21	Maximum completed in any enterprise.....miles		1.0				15.0	1.5		
22	Maximum size of tile ¹.....inches		14				30	22		
23	Accessory levees and dikes:									
24	Completed.....miles	1.2	8.4	24.0			23.6	20.8	45.7	
25	Additional under construction.....miles				6.0			9.1	7.7	
26	Pumping plants:									
27	Engine capacity.....horsepower		(²)	(³)			1,500			
28	Pump capacity.....gallons per minute		(²)	(³)			225,000			
29	Area served by pumps.....acres		6,984	15,000			23,794			
30	Area drained by open ditches only ¹.....acres	6,950	9,141		40,653	17,244		197,521	247,105	16,208
31	Length of these ditches.....miles	21.5	24.1		60.6	19.0		209.5	608.0	36.2
32	Average length per acre.....feet	16.3	13.9		7.9	5.8		5.6	13.0	11.8
33	Area having open ditches and levees ¹.....acres	5,129		16,800	7,554			(⁴)	124,182	
34	Length of these ditches.....miles	1.6		29.2	14.1			6.8	117.8	
35	Average length per acre.....feet	1.6		9.2	9.9				5.0	
36	Length of these accessory levees ¹.....miles	1.2		24.0	6.0			29.7	53.4	
37	Area drained by tile only ¹.....acres							700		
38	Length of these tile.....miles							4.0		
39	Average length per acre.....feet							27.8		
40	Area drained by open ditches and tile ¹.....acres						4,010			
41	Length of these drains.....miles						22.5			
42	Average length per acre.....feet						29.6			
43	Area having tile and levees ¹.....acres									
44	Length of these tile.....miles									
45	Average length per acre.....feet									
46	Length of these accessory levees.....miles									
47	Area having open ditches, tile, and levees ¹.....acres		6,984				19,784	6,564		
48	Length of these drains.....miles		9.9				22.1	18.0		
49	Average length per acre.....feet		7.5				5.9	14.5		
50	Length of these accessory levees.....miles		8.4				23.6	0.2		
DEVELOPMENT OF LAND.										
51	Improved land in operating enterprises, 1920.....acres	10,871	14,040	16,050	39,165	8,622	20,084	130,575	190,039	14,624
52	Improved land prior to drainage.....acres	10,871	7,172	5,460	38,036	1,724	7,125	61,991	77,511	13,813
53	Increase since drainage.....acres		6,868	10,590	1,129	6,898	12,959	68,584	112,528	811
54	Per cent of increase.....		95.8	194.0	3.0	400.1	181.9	110.6	145.2	5.9
55	Per cent increase is of all improved land in farms, 1920.....		2.8	4.2	0.4	1.7	6.8	43.9	57.6	0.2
56	Timber and cut-over land, 1920.....acres	1,208	1,747	750	9,042	1,724	2,052	73,314	181,248	1,584
57	Timber and cut-over land prior to drainage.....acres	1,208	4,017	7,590	10,171	1,724	7,265	138,073	233,776	2,895
58	Decrease since drainage.....acres		2,270	6,840	1,129		5,213	64,759	112,528	811
59	Per cent of decrease.....		50.5	90.1	11.1		71.8	46.9	88.3	33.9
60	Other unimproved land, 1920.....acres		338			6,898	1,658	956		
61	Other unimproved land prior to drainage.....acres		4,936	3,750		13,796	9,404	4,781		
62	Decrease since drainage.....acres		4,598	3,750		6,898	7,746	3,825		
63	Per cent of decrease.....		93.2	100.0		50.0	82.4	80.0		
64	Swampy or subject to overflow, 1920.....acres	381	172	750	27,243	1,724		35,275	57,169	36
65	Swampy or subject to overflow prior to drainage.....acres	12,079	16,125	12,870	43,350	17,244	23,794	126,955	263,087	16,062
66	Decrease since drainage.....acres	11,698	15,953	12,120	16,143	15,520	23,794	91,680	205,918	16,026
67	Per cent of decrease.....	96.8	98.9	94.2	37.2	90.0	100.0	72.2	78.3	99.8
CAPITAL INVESTED AND COST PER ACRE.										
68	Total capital invested in and required for completion of operating enterprises.....dollars	50,965	396,113	273,400	326,710	140,000	919,605	1,679,360	3,976,150	130,000
69	Capital invested in these enterprises to Dec. 31, 1919.....dollars	50,965	396,113	273,400	278,710	140,000	919,605	1,435,050	3,640,650	130,000
70	Additional capital required to complete these enterprises.....dollars				48,000			244,250	335,500	
71	Average cost per acre when completed.....dollars	4.22	24.57	16.27	6.78	8.12	38.65	8.20	10.71	8.02
72	Enterprises constructing open ditches only.....dollars	37,137	119,888		166,710	140,000		1,067,800	3,080,150	130,000
73	Average cost per acre when completed.....dollars	5.34	13.12		4.10	8.12		5.41	12.46	8.02
74	Enterprises constructing open ditches and levees.....dollars	13,828		273,400	160,000			454,000	896,000	
75	Average cost per acre when completed.....dollars	2.70		16.27	21.18				7.22	
76	Enterprises constructing tile drains only.....dollars							17,500		
77	Average cost per acre when completed.....dollars							23.03		
78	Enterprises constructing open ditches and tile drains.....dollars						150,000			
79	Average cost per acre when completed.....dollars						37.41			
80	Enterprises constructing tile drains and levees.....dollars									
81	Average cost per acre when completed.....dollars									
82	Enterprises constructing open ditches, tile drains, and levees.....dollars		276,225				769,605	140,000		
	Average cost per acre when completed.....dollars		39.55				38.90	21.33		
CROPS.										
83	Improved land in enterprises reporting—									
84	Corn as principal crop on drained land.....acres	10,871	8,419	1,800	33,500	8,622		74,085	154,239	14,624
85	Cotton as principal crop on drained land.....acres								29,800	
86	Wheat as principal crop on drained land.....acres		5,621	14,250	5,665		20,084	56,480	6,000	

¹ When works under construction have been completed.
² Pump located in Marion County.

³ Pump located in Pike County.
⁴ Included in area drained by open ditches only.

DRAINAGE—MISSOURI.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Pemiscot.	Perry.	Pike.	Platte.	Ray.	Ripley.	St. Charles.	St. Louis.
LAND AREA.									
1	Approximate land area of the county.....	acres.. 291,840	295,680	417,920	265,600	361,600	401,280	342,400	311,680
2	All land in operating drainage enterprises.....	acres.. 270,118	25,000	14,430	4,914	7,448	29,576	18,275	4,509
3	Improved land.....	acres.. 81,641	22,000	8,608	4,914	6,897	17,745	17,070	4,509
4	Per cent of all improved land in farms.....	acres.. 69.0	13.4	2.9	2.6	2.6	20.2	7.4	2.5
5	Timber and cut-over land.....	acres.. 188,477	3,000	5,822			11,831	1,138	
6	Other unimproved land.....	acres..				551		67	
7	Swampy or subject to overflow, in enterprises.....	acres..		5,400		551	7,394	2,100	
8	Suffering a loss of crops from defective drainage.....	acres.. 71,815				248	4,436	49	
9	Assessed acreage.....	270,118	25,000	14,430	4,914	7,448	29,576	18,275	4,509
10	Excess over all land in operating enterprises.....	acres..							
DRAINAGE WORKS.									
Open ditches:									
11	Completed.....	miles.. 246.8	20.0	17.7	8.2	17.8	31.2	18.7	14.6
12	Additional under construction.....	miles.. 116.0						0.4	
13	Maximum completed in any enterprise.....	miles.. 130.1	20.0	10.7	8.2	11.0	11.1	8.1	10.0
14	Maximum width at bottom of ditch ¹	feet.. 123	20	30	12	40	30	32	14
15	Maximum of average depths of outlet ditches ¹	feet.. 12.0	8.0	18.0	12.0	10.0	7.5	20.0	9.0
16	Mean depth of branch ditches ¹	feet.. 7.4	6.0	4.0		4.0	6.1		4.0
Tile drains:									
17	Completed.....	miles..							
18	Additional under construction.....	miles..							
19	Maximum completed in any enterprise.....	miles..							
20	Maximum size of tile ¹	inches..							
Accessory levees and dikes:									
21	Completed.....	miles.. 20.0	10.0	33.3		1.3			
22	Additional under construction.....	miles..		2.2					
Pumping plants:									
23	Engine capacity.....	horsepower..		550					
24	Pump capacity.....	gallons per minute..		190,000					
25	Area served by pumps.....	acres..		14,430					
26	Area drained by open ditches only ¹	acres.. 191,508			4,914	1,938	29,576	18,275	4,509
27	Length of these ditches.....	miles.. 232.7			3.2	6.8	31.2	19.1	14.5
28	Average length per acre.....	feet.. 6.4			3.4	18.5	5.6	5.5	17.0
29	Area having open ditches and levees ¹	acres.. 78,610	25,000	14,430		5,510			
30	Length of these ditches.....	miles.. 130.1	20.0	17.7		11.0			
31	Average length per acre.....	feet.. 8.7	4.2	6.5		10.5			
32	Length of these accessory levees.....	miles.. 20.0	10.0	35.5		1.3			
33	Area drained by tile only ¹	acres..							
34	Length of these tile.....	miles..							
35	Average length per acre.....	feet..							
36	Area drained by open ditches and tile ¹	acres..							
37	Length of these drains.....	miles..							
38	Average length per acre.....	feet..							
39	Area having tile and levees ¹	acres..							
40	Length of these tile.....	miles..							
41	Average length per acre.....	feet..							
42	Length of these accessory levees.....	miles..							
43	Area having open ditches, tile, and levees ¹	acres..							
44	Length of these drains.....	miles..							
45	Average length per acre.....	feet..							
46	Length of these accessory levees.....	miles..							
DEVELOPMENT OF LAND.									
47	Improved land in operating enterprises, 1920.....	acres.. 81,641	22,000	8,608	4,914	6,897	17,745	17,070	4,509
48	Improved land prior to drainage.....	acres.. 40,660	22,000	2,708	2,457	2,128	11,831	12,829	2,615
49	Increase since drainage.....	acres.. 40,981		5,900	2,457	4,769	5,914	4,241	1,894
50	Per cent of increase.....	100.8		217.9	100.0	224.1	50.0	33.1	72.4
51	Per cent increase is of all improved land in farms, 1920.....	34.6		2.0	1.3	1.8	6.7	1.8	1.1
52	Timber and cut-over land, 1920.....	acres.. 188,477	3,000	5,822			11,831	1,138	
53	Timber and cut-over land prior to drainage.....	acres.. 229,453	3,000	9,615		97	17,745	1,138	792
54	Decrease since drainage.....	acres.. 40,961		3,793		97	5,914		792
55	Per cent of decrease.....	17.0		39.4		100.0	33.3		100.0
56	Other unimproved land, 1920.....	acres..				551		67	
57	Other unimproved land prior to drainage.....	acres..		2,107	2,457	5,223		4,308	1,102
58	Decrease since drainage.....	acres..		2,107	2,457	4,672		4,241	1,102
59	Per cent of decrease.....			100.0	100.0	89.5		98.4	100.0
60	Swampy or subject to overflow, 1920.....	acres..		5,400		551	7,394	2,100	
61	Swampy or subject to overflow prior to drainage.....	acres.. 267,760	17,500	11,722	4,914	5,611	17,745	3,750	3,907
62	Decrease since drainage.....	acres.. 267,760	17,500	6,322	4,914	5,060	10,351	1,650	3,907
63	Per cent of decrease.....	100.0	100.0	53.0	100.0	90.2	58.3	44.0	100.0
CAPITAL INVESTED AND COST PER ACRE.									
64	Total capital invested in and required for completion of operating enterprises.....	dollars.. 3,624,505	122,000	504,600	15,000	77,175	90,260	80,339	39,294
65	Capital invested in these enterprises to Dec. 31, 1919.....	dollars.. 2,359,988	122,000	484,600	15,000	77,175	90,260	79,339	38,294
66	Additional capital required to complete these enterprises.....	dollars.. 1,264,517		20,000				1,000	
67	Average cost per acre when completed.....	dollars.. 13.42	4.88	34.97	3.05	10.36	3.05	4.40	8.71
68	Enterprises constructing open ditches only.....	dollars.. 2,416,505			15,000	24,785	90,260	80,339	39,294
69	Average cost per acre when completed.....	dollars.. 12.62			3.05	12.79	3.05	4.40	8.71
70	Enterprises constructing open ditches and levees.....	dollars.. 1,208,000	122,000	504,600		52,390			
71	Average cost per acre when completed.....	dollars.. 15.37	4.88	34.97		9.51			
72	Enterprises constructing tile drains only.....	dollars..							
73	Average cost per acre when completed.....	dollars..							
74	Enterprises constructing open ditches and tile drains.....	dollars..							
75	Average cost per acre when completed.....	dollars..							
76	Enterprises constructing tile drains and levees.....	dollars..							
77	Average cost per acre when completed.....	dollars..							
78	Enterprises constructing open ditches, tile drains, and levees.....	dollars..							
79	Average cost per acre when completed.....	dollars..							
CROPS.									
80	Improved land in enterprises reporting—								
81	Corn as principal crop on drained land.....	acres.. 9,797	22,000	600	4,914	4,959	17,745		
82	Cotton as principal crop on drained land.....	acres.. 71,844							
	Wheat as principal crop on drained land.....	acres..		8,008		1,938		17,070	4,509

¹ When works under construction have been completed.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Saline.	Scotland.	Scott.	Shelby.	Stoddard.	Wayne.	Worth.	Other counties. ¹	
LAND AREA.										
1	Approximate land area of the county.....	acres..	482,560	280,960	268,160	325,760	521,600	496,000	169,600	3,892,400
2	All land in operating drainage enterprises.....	acres..	7,184	15,110	154,335	9,697	375,037	9,000	7,013	23,262
3	Improved land.....	acres..	6,713	6,807	116,441	7,453	194,315	900	3,156	20,111
4	Per cent of all improved land in farms.....	.....	1.8	3.0	66.7	2.9	72.7	0.9	2.2	0.7
5	Timber and cut-over land.....	acres..	471	3,445	37,894	2,244	180,722	8,100	351	1,070
6	Other unimproved land.....	acres..		4,798					3,506	2,081
7	Swampy or subject to overflow, in enterprises.....	acres..	471	1,300	1,950		62,837	8,100	5,961	3,993
8	Suffering a loss of crops from defective drainage.....	acres..			5,062	7,966	13,950	450		1,865
9	Assessed acreage.....	acres..	7,184	15,110	229,724	9,697	375,037	9,000	7,013	23,262
10	Excess over all land in operating enterprises.....	acres..			75,380					
DRAINAGE WORKS.										
Open ditches:										
11	Completed.....	miles..	21.3	37.5	245.2	12.7	459.5	0.5	2.3	47.6
12	Additional under construction.....	miles..			3.1		48.4	22.2	15.1	3.5
13	Maximum completed in any enterprise.....	miles..	6.5	17.5	55.7	10.2	179.3	0.5	2.3	10.8
14	Maximum width at bottom of ditch ²	feet..	35	18	60	75	81	40	22	60
15	Maximum of average depths of outlet ditches ²	feet..	8.0	9.0	15.0	14.5	12.0	12.0	15.0	12.0
16	Mean depth of branch ditches ²	feet..	4.0		7.3	7.0	7.2	8.0	7.0	6.6
Tile drains:										
17	Completed.....	miles..								0.4
18	Additional under construction.....	miles..			0.5					
19	Maximum completed in any enterprise.....	miles..								0.2
20	Maximum size of tile ²	inches..								12
Accessory levees and dikes:										
21	Completed.....	miles..	9.4		25.0	10.2	0.5			5.2
22	Additional under construction.....	miles..					5.4	2.6		8.0
Pumping plants:										
23	Engine capacity.....	horsepower..	60							
24	Pump capacity.....	gallons per minute..	7,000							
25	Area served by pumps.....	acres..	1,000							
26	Area drained by open ditches only ²	acres..		15,110	70,359	1,200	347,537		7,013	18,756
27	Length of these ditches.....	miles..		37.5	100.1	2.5	444.4		17.4	36.2
28	Average length per acre.....	feet..		13.1	7.5	11.0	6.8		13.1	10.2
29	Area having open ditches and levees ²	acres..	7,184		74,228	8,497	27,500	9,000		2,691
30	Length of these ditches.....	miles..	21.3		180.7	10.2	63.5	22.7		10.9
31	Average length per acre.....	feet..	15.7		9.3	6.3	12.2	13.3		21.4
32	Length of these accessory levees.....	miles..	9.4		25.0	10.2	5.9	2.6		9.2
33	Area drained by tile only ²	acres..								
34	Length of these tile.....	miles..								
35	Average length per acre.....	feet..								
36	Area drained by open ditches and tile ²	acres..			9,750					
37	Length of these drains.....	miles..			18.0					
38	Average length per acre.....	feet..			9.7					
39	Area having tile and levees ²	acres..								
40	Length of these tile.....	miles..								
41	Average length per acre.....	feet..								
42	Length of these accessory levees.....	miles..								
43	Area having open ditches, tile, and levees ²	acres..								1,815
44	Length of these drains.....	miles..								4.4
45	Average length per acre.....	feet..								12.8
46	Length of these accessory levees.....	miles..								4.0
DEVELOPMENT OF LAND.										
47	Improved land in operating enterprises, 1920.....	acres..	6,713	6,867	116,441	7,453	194,315	900	3,156	20,111
48	Improved land prior to drainage.....	acres..	4,343	4,533	29,354	480	71,309	900	3,156	12,716
49	Increase since drainage.....	acres..	2,370	2,334	87,087	6,973	123,006			7,995
50	Per cent of increase ³.....	.....	64.6	51.5	296.7		172.5			58.2
51	Per cent increase is of all improved land in farms, 1920.....	.....	0.6	1.0	49.9	2.7	46.0			0.3
52	Timber and cut-over land, 1920.....	acres..	471	3,445	37,894	2,244	180,722	8,100	351	1,070
53	Timber and cut-over land prior to drainage.....	acres..	471	5,288	120,680	3,274	303,728	8,100	351	1,943
54	Decrease since drainage.....	acres..		1,843	82,786	1,030	123,006			873
55	Per cent of decrease.....	.....		54.0	68.6	31.5	40.5			44.9
56	Other unimproved land, 1920.....	acres..		4,798						
57	Other unimproved land prior to drainage.....	acres..	2,370	5,289	4,301	5,943			3,506	2,081
58	Decrease since drainage.....	acres..	2,370	491	4,301	5,943			3,506	8,603
59	Per cent of decrease.....	.....	100.0	9.3	100.0	100.0				6,522
60	Swampy or subject to overflow, 1920.....	acres..	471	1,300	1,950		62,837	8,100	5,961	3,993
61	Swampy or subject to overflow prior to drainage.....	acres..	3,927	15,110	114,917	6,723	303,728	8,100	5,961	17,348
62	Decrease since drainage.....	acres..	3,456	13,810	112,967	6,723	240,891			13,355
63	Per cent of decrease.....	.....	88.0	91.4	98.3	100.0	79.3			77.0
CAPITAL INVESTED AND COST PER ACRE.										
64	Total capital invested in and required for completion of operating enterprises.....	dollars..	82,542	144,324	1,008,981	90,588	2,996,940	155,000	170,000	230,935
65	Capital invested in these enterprises to Dec. 31, 1919.....	dollars..	82,542	144,324	989,981	90,588	2,659,540	3,100	16,000	207,310
66	Additional capital required to complete these enterprises.....	dollars..			10,000		337,400	151,900	154,000	23,625
67	Average cost per acre when completed.....	dollars..	11.49	9.55	6.54	9.34	7.99	17.22	24.24	9.93
68	Enterprises constructing open ditches only.....	dollars..		144,324	227,517	18,588	2,644,623		170,000	159,935
69	Average cost per acre when completed.....	dollars..		9.55	3.23	15.49	7.61		24.24	8.53
70	Enterprises constructing open ditches and levees.....	dollars..	82,542		686,464	72,000	352,317	155,000		31,000
71	Average cost per acre when completed.....	dollars..	11.49		9.25	8.47	12.81	17.22		11.52
72	Enterprises constructing tile drains only.....	dollars..								
73	Average cost per acre when completed.....	dollars..								
74	Enterprises constructing open ditches and tile drains.....	dollars..			95,000					
75	Average cost per acre when completed.....	dollars..			9.74					
76	Enterprises constructing tile drains and levees.....	dollars..								
77	Average cost per acre when completed.....	dollars..								
78	Enterprises constructing open ditches, tile drains, and levees.....	dollars..								40,000
79	Average cost per acre when completed.....	dollars..								22.04
CROPS.										
80	Improved land in enterprises reporting—									
81	Corn as principal crop on drained land.....	acres..	4,241	6,867	76,371	7,453	194,315	900	3,156	14,468
82	Cotton as principal crop on drained land.....	acres..			40,070					5,643
83	Wheat as principal crop on drained land.....	acres..	2,472							

¹ Includes only Andrew, Buchanan, Caldwell, Callaway, Clay, Grundy, Howard, Jackson, Linn, Osage, Putnam, and Schuyler Counties.² When works under construction have been completed.³ Per cent not shown when more than 1,000.

FOURTEENTH CENSUS OF THE UNITED STATES: 1920

DEPARTMENT
OF COMMERCE

BULLETIN

BUREAU OF
THE CENSUS

DRAINAGE : MONTANA

STATISTICS FOR THE STATE AND ITS COUNTIES

Prepared under the supervision of WILLIAM LANE AUSTIN, Chief Statistician for Agriculture, by ROGER D. MARSDEN, Special Agent in Charge of Drainage

CONTENTS.

	Page.		Page.
INTRODUCTION.....	1	DRAINAGE ENTERPRISES—Continued.	
MAP SHOWING OPERATING DRAINAGE ENTERPRISES.....	2	Size of enterprises.....	4
DRAINAGE ON FARMS.....	3	Character of enterprises.....	4
Explanation of terms.....	3	Drainage works.....	5
Farms and farm land.....	3	Maintenance of works.....	6
DRAINAGE ENTERPRISES.....	3	Date of organization.....	6
Explanation of terms.....	3	Crops.....	6
Operating and nonoperating enterprises.....	4	COUNTY TABLES:	
Location of enterprises.....	4	I.—Drainage on farms: 1920.....	7
Condition of land in enterprises.....	4	II.—Operating drainage enterprises: 1920.....	8

INTRODUCTION.

This bulletin presents the statistics of drainage for Montana collected at the census of 1920. The figures relate to conditions as of January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of unimproved land not yet in farms. The

statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner constructs on his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

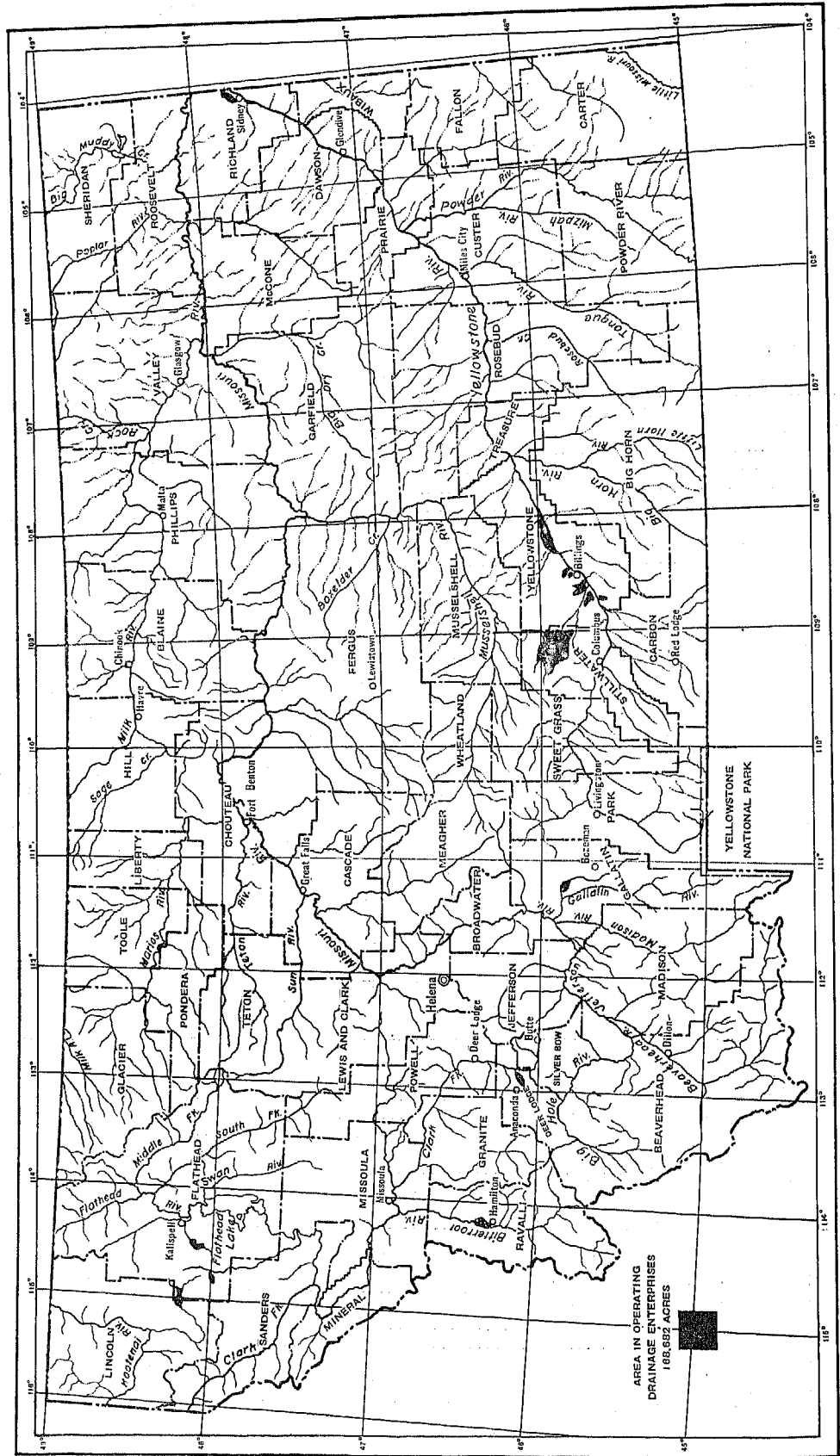
TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
DRAINAGE ON FARMS.		
Number of all farms in the state.....	57,677	100.0
Farms reporting land having drainage.....	756	1.3
Farms reporting land needing drainage.....	1,728	3.0
All land in farms.....acres.	35,070,656	100.0
Improved land in farms.....acres.	11,007,278	31.4
Farm land reported as provided with drainage.....acres.	51,146	0.1
Farm land reported as needing drainage.....acres.	113,293	0.3
DRAINAGE ENTERPRISES.		
Approximate land area of the state.....acres.	93,523,840	100.0
All land in operating drainage enterprises.....acres.	168,682	0.2
Improved land.....acres.	141,252	0.2
Unimproved land ¹.....acres.	27,430	(²)
Total capital invested in and required for completion of operating enterprises.....	\$846,466	100.0
Capital invested in these enterprises to Dec. 31, 1919.....	\$664,990	78.6
Additional capital required to complete these enterprises.....	\$181,476	21.4

¹ No timber or cut-over land reported.² Less than one-tenth of 1 per cent.

MONTANA

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



DRAINAGE ON FARMS.

Explanation of terms.—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which are substantially as follows:

Drainage of agricultural land was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purpose of improving the condition of the soil and crops.

The area provided with drainage, in farms, is the acreage actually benefited or made of more value for agricultural purposes by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land not now suitable for crops which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators have answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual." Levee districts, however, generally are not included in the enterprises for which data are given in this bulletin (see definition of drainage enterprises, below).

Farms and farm land.—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for growing crops by reason of the drainage. This is to be distinguished from the area merely provided with outlet facilities by organized drainage enterprises. Drainage on farms represents in most cases the result of work done by the farm owner, either independently or supplemental to the work done by a drainage enterprise, but the acreage would include also any farm land receiving similar benefits directly from the works of an enterprise.

DRAINAGE ENTERPRISES.

Explanation of terms.—The more important terms used in connection with the census of drainage enterprises were defined as follows:

Drainage enterprises comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swamp or overflowed land for sale, other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditches or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise, though the capacities of drainage pumping plants are given only in the counties in which the plants are located.

Operating enterprises, as designated in this bulletin, are those that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

Land in drainage enterprises comprises the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises, deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (a) improved land; (b) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (c) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be considerably greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprises.

Timber and cut-over land includes farm woodland of natural or

planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, land subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering loss of crops is intended to include only land devoted to planted crops which suffer damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A pumping district is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

Operating and nonoperating enterprises.—In the tables that follow, statistics are given for operating enterprises only, as no nonoperating drainage enterprises were found in Montana. The operating enterprises, as already defined, include both those that have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of drainage works some years ago but were constructing extensions or enlargements on January 1, 1920.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES. CLASSIFIED AS BETWEEN WORKS COMPLETED AND WORKS UNDER CONSTRUCTION: 1920.

CLASS.	LAND.		CAPITAL. ¹		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	168,682	100.0	\$664,900	100.0	\$181,476
With works completed.....	44,682	26.5	393,909	59.2	.....
With works under construction...	124,000	73.5	271,021	40.8	181,476

¹ The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—Of the 17 drainage enterprises in Montana, 8 are situated in Yellowstone County, in the south-central part of the state, 6 are west of the Continental Divide, and the 3 others are in Gallatin, Richland, and Stillwater Counties.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	168,682	100.0	\$664,900	100.0	\$181,476
Clarks Fork.....	6,700	4.0	22,706	3.4	.....
Kootenai River.....	7,650	4.5	127,000	19.1	.....
Yellowstone River.....	149,332	88.5	510,974	76.8	181,476
Missouri River.....	5,000	3.0	4,250	0.6	.....

Condition of land in enterprises.—With one exception, all the enterprises east of the Continental Divide are for the drainage and protection of land damaged or threatened with water-logging and the concentration of salts, commonly called alkali, in the surface soil as a result of irrigation. The enterprises on the Pacific slope are reported as all for the drainage and protection of land that was swampy or subject to overflow by stream floods.

For the state, 3,930 acres in drainage districts and 61,831 acres in United States Reclamation Service projects are reported as not having needed drainage, or not expected to receive drainage or protection from

the improvement works authorized, but as having been assessed merely as being responsible for damage to the other land. This acreage in the United States Reclamation Service projects has been omitted from the tabulations in this bulletin.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflows for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy, subject to overflow, seeped, or alkali, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.			
	Total.		Works completed (acres).	Works under construction (acres).
	Acreage.	Per cent of all land.		
All land in enterprises.....	168,682	100.0	44,682	124,000
Improved land.....	141,252	83.7	38,642	102,610
Unimproved land ¹	27,430	16.3	6,040	21,390
Swampy, subject to overflow, seeped, etc.	19,630	11.6	1,640	17,990
Suffering a loss of crops.....	21,964	13.0	3,004	18,960

¹ No timber or cut-over land reported.

Size of enterprises.—The average area included in the 17 drainage enterprises in Montana is 9,922 acres. None of the enterprises embraces land in more than one county, and there is no overlapping of the enterprises in this state.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	168,682	168,682	100.0
500 to 999 acres.....	1,307	1,307	0.8
1,000 to 4,999 acres.....	23,711	23,711	14.1
5,000 to 9,999 acres.....	19,664	19,664	11.7
10,000 to 100,000 acres.....	124,000	124,000	73.5

Character of enterprises.—Most of the drainage enterprises organized under the state laws were established in accordance with the law of March 7, 1905 (ch. 106). That law provided for a county drain commissioner, with duties generally the same as provided in the law of March 11, 1915 (ch. 147), and for a very similar method of organizing drainage districts. Amendments made in 1907 and 1909 did not affect the form of organization.

The drainage law of 1915 provides for the appointment of a county drain commissioner by the board of county commissioners, to have jurisdiction over all established drains in his county. A petition for a drain must be signed by not less than ten freeholders of the county, including at least five (or at least half when the whole number is five or less) who own land liable for assessment for the proposed improvement. The tracts of land and the cities, towns, counties, railways, and irrigation ditches assessed for the construction of a drain comprise the drainage district. Land liable to become water-logged may be included. Damages and inconvenience caused by seepage and waste water from irrigation ditches and higher land are to be considered in apportioning the cost, which is borne by the various parts of the district in proportion to the benefits that will be conferred.

A first order of determination for the drainage district is issued by the drain commissioner if his preliminary examination indicates that the enterprise is practicable; the final order of determination is issued when right of way for the drain has been secured. The plan of drainage is determined by the drain commissioner, who lets contract for construction. Damages for right of way are awarded by a board of special commissioners appointed by the district court. If this board decides that the drain is unnecessary, proceedings for establishing the drain are dismissed at the applicants' expense. Appeal from this board's award may be taken to the district court for jury trial. Apportionment of the cost is made by the drain commissioner, subject to review by a board appointed by the district court and to further appeal for jury trial. This board of review may add to the district or eliminate any part of it. Public hearings are held upon the petition for commissioners to determine damages and upon the drain commissioner's apportionment of cost. Damages awarded each individual are deducted from the assessment of cost made against him. The number of installments for collecting the drainage taxes, which must not extend more than 10 years, is determined by the drain commissioner. Payments for damages, services, and materials are made by warrants drawn upon the funds of the district, but those for land and for damages in excess of benefits will be paid from general county funds, which will be reimbursed by the district.

Petition for a drain to be located or to confer benefits in more than one county may be filed in either county affected. The drain commissioners act jointly, but after they apportion the total cost between the counties each makes the apportionment within his own county.

Drainage and protection against seepage and alkali for land in projects of the United States Reclamation Service may be provided by that service as such improvement works are deemed necessary.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises ¹	168,682	100.0	\$964,990	100.0	\$181,476
Drainage districts.....	129,432	76.7	208,173	31.3	104,043
Laws of 1905, ch. 106.....	29,432	17.4	183,150	27.5	.....
Laws of 1915, ch. 147.....	100,000	59.3	25,023	3.8	104,043
U. S. Reclamation Service.....	25,000	15.2	322,597	48.5	77,433
Individual ownership ²	13,650	8.1	134,250	20.2	.....

¹ No nonoperating enterprises reported.

² Includes 1,000 acres in commercial development.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 102.1 miles of open ditches and 50.7 miles of tile drains; the additional lengths under construction were 1.3 miles of open ditches and 36.2 miles of tile drains. These figures do not include drains installed by individual farm owners supplemental to the works of the enterprises. No levees or dikes have been built or authorized by any of the drainage enterprises. There are no pumping districts for land drainage in the state.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	168,682	100.0	\$964,990	100.0	\$181,476
Open ditches only.....	42,082	24.9	314,400	47.3	.....
Open ditches and tile drains ¹	126,600	75.1	350,590	52.7	181,476

¹ Includes 1,000 acres drained by tile only.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 14 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 15 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet were

omitted; to include this group, computed as 3 feet, would show the mean depth for the state 6.0 instead of 6.3 feet.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	168,682	100.0
Less than 3 feet.....	3,650	2.2
3.0 to 3.9 feet.....	5,000	3.0
4.0 to 4.9 feet.....	4,000	2.4
5.0 to 5.9 feet.....	24,000	14.2
6.0 to 6.9 feet.....	132,032	78.3
7.0 to 7.9 feet.....		
Not reporting branches.....		

Maintenance of works.—The drainage law of 1915 requires the county drain commissioner to keep the drains under his supervision in proper repair, and to include in his annual report to the board of county commissioners an estimate of the funds that will be required during the ensuing year for inspection and maintenance of each drain. The assessment for maintenance and repair shall not exceed in any year 5 per cent of the cost of original construction. The cost of the maintenance work is assessed against the parts of the district according to the benefits that will accrue, though this may be different from the apportionment of the cost of original construction. If the total cost for any maintenance work is estimated to exceed the funds available for that drain, application must be filed and a special assessment levied, in most respects the same as for establishing a new drain.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.			
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.	
			Amount.	Per cent of total.		
All operating enterprises.....	168,682	100.0	\$664,990	100.0	\$181,476	
By district forces.....	25,600	15.2	322,567	48.5	77,433	
By contract.....	23,732	14.1	163,384	24.6		
No maintenance provided ¹	10,350	6.1	55,250	8.3		
Not reporting.....	109,000	64.6	123,789	18.6	104,043	

¹ Includes 3,650 acres maintained by landowners.

Date of organization.—The progress of development in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the drain commissioners, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or

of the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of reclamation was completed. No drainage enterprises were reported as organized in Montana earlier than 1905.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	168,682	100.0	168,682	100.0
1905 to 1909.....	21,533	12.8	21,533	12.8
1910 to 1914.....	30,499	18.1	30,499	18.1
1915 to 1919.....	104,000	61.7	104,000	61.7
Not reported ¹	12,650	7.5	12,650	7.5

¹ All under individual ownership.

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$664,990	100.0	\$181,476
1905 to 1909.....	105,248	15.8	
1910 to 1914.....	67,136	10.1	
1915 to 1919.....	284,787	42.8	181,476
Not reported ¹	207,819	31.3	

¹ All under individual ownership.

TABLE 12.—DRAINS (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.	
	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains.....	103.4	100.0	80.9	100.0
1905 to 1909.....	24.0	23.2		
1910 to 1914.....	11.2	10.8	82.0	93.4
1915 to 1919.....	20.7	20.0	3.8	4.4
Not reported ¹	47.5	45.9	1.1	1.3

¹ All under individual ownership.

Crops.—The principal crops grown upon the drained land in drainage enterprises are wheat, alfalfa, and hay other than alfalfa. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE—MONTANA.

7

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Beaverhead.	Blaine.	Carbon.	Deer Lodge.	Flathead.
1	Number of all farms in the state or county.....	57,677	642	1,761	1,353	202	1,923
2	Farms reporting land having drainage.....	750	9	4	35	57	111
3	Farms reporting land needing drainage.....	1,728	39	9	79	11	410
4	Farms in drainage and levee districts.....	336			3	50	23
LAND AND FARM AREA.							
5	Approximate land area of the state or county.....acres..	93,523,840	3,620,480	2,706,560	1,318,400	476,800	3,909,760
6	All land in farms.....acres..	55,070,656	637,009	1,150,050	446,386	58,484	470,283
7	Improved land in farms.....acres..	11,007,278	270,003	291,431	178,503	24,210	179,201
8	Woodland in farms.....acres..	1,016,462	7,142	11,334	17,644	3,143	127,244
9	Other unimproved land in farms.....acres..	22,416,916	359,264	856,291	250,239	31,131	163,838
10	Farm land reported as provided with drainage.....acres..	51,146	977	950	1,145	1,127	7,898
11	Farm land reported as needing drainage.....acres..	113,293	2,025	432	3,316	733	24,598
12	Drainage only.....acres..	30,342	1,231	167	1,805	360	1,297
13	Drainage and clearing.....acres..	70,951	794	265	1,511	373	23,301

		Gallatin.	Granite.	Jefferson.	Lincoln.	Madison.	Missoula.
1	Number of all farms in the county.....	1,349	354	555	341	901	1,323
2	Farms reporting land having drainage.....	48	12	6	34	11	39
3	Farms reporting land needing drainage.....	109	60	17	59	57	83
4	Farms in drainage and levee districts.....	12			1	1	2
LAND AND FARM AREA.							
5	Approximate land area of the county.....acres..	1,604,480	1,098,880	1,044,480	2,319,300	2,318,080	2,030,720
6	All land in farms.....acres..	783,189	254,148	281,494	65,050	564,516	388,408
7	Improved land in farms.....acres..	350,776	72,336	80,933	16,894	168,035	173,031
8	Woodland in farms.....acres..	35,261	30,961	4,421	33,670	11,162	72,897
9	Other unimproved land in farms.....acres..	397,152	150,851	196,140	14,177	384,719	142,480
10	Farm land reported as provided with drainage.....acres..	5,881	1,407	870	1,324	546	4,628
11	Farm land reported as needing drainage.....acres..	6,587	4,914	348	4,095	6,316	6,126
12	Drainage only.....acres..	3,687	373	208	361	4,755	515
13	Drainage and clearing.....acres..	2,900	4,541	140	3,734	1,561	5,611

		Phillips.	Powell.	Ravalli.	Richland.	Yellowstone.	All other counties. ¹
1	Number of all farms in the county.....	1,914	476	1,231	1,577	2,211	39,564
2	Farms reporting land having drainage.....	7	13	42	7	260	61
3	Farms reporting land needing drainage.....	7	51	180	46	147	304
4	Farms in drainage and levee districts.....		2	6	1	222	13
LAND AND FARM AREA.							
5	Approximate land area of the county.....acres..	3,813,920	1,490,560	1,530,240	1,345,920	1,671,040	61,724,160
6	All land in farms.....acres..	1,084,725	620,065	245,965	812,104	1,067,425	26,232,259
7	Improved land in farms.....acres..	227,811	125,924	114,473	311,006	333,174	8,088,337
8	Woodland in farms.....acres..	6,239	73,002	43,480	11,242	268,423	887,988
9	Other unimproved land in farms.....acres..	850,675	320,239	88,012	489,946	465,828	17,255,934
10	Farm land reported as provided with drainage.....acres..	780	2,642	1,190	1,047	15,592	3,142
11	Farm land reported as needing drainage.....acres..	311	4,026	7,335	2,806	3,955	35,370
12	Drainage only.....acres..	210	1,681	903	1,425	3,339	14,025
13	Drainage and clearing.....acres..	101	2,345	6,432	1,381	616	21,345

¹ No drainage on farms reported in Carter, Chouteau, Custer, Garfield, Hill, Liberty, Pondera, Powder River, Prairie, Roosevelt, Sheridan, Stillwater, Valley, Wheatland and Wibaux Counties.

DRAINAGE—MONTANA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Deer Lodge, Flathead, Lincoln, and Ravalli.	Gallatin, Richland, and Stillwater.	Yellow- stone.
LAND AREA.					
1	Approximate land area of the state or county.....	acres 93,523,840	8,236,160	4,087,680	1,671,040
2	All land in operating drainage enterprises.....	acres 168,682	14,350	103,600	47,732
3	Improved land.....	acres 141,252	9,150	89,170	42,932
4	Percent of all improved land in farms, 1920.....	1.3	2.7	9.5	12.9
5	Unimproved land ¹	acres 27,430	5,200	17,430	4,800
6	Swampy, subject to overflow, seeped, or alkali land, in enterprises.....	acres 19,630	800	17,430	1,400
7	Suffering a loss of crops from defective drainage.....	acres 21,954	300	21,654	.....
8	Assessed acreage.....	acres 168,682	14,350	103,600	47,732
9	Excess over all land in enterprises.....	acres.....	.....	.....	.....
DRAINAGE WORKS.					
10	Open ditches:				
11	Completed.....	miles 102.1	45.7	15.2	41.2
12	Additional under construction.....	miles 1.3	.....	1.3	.....
13	Maximum completed in any enterprise.....	miles 20.0	20.0	8.5	16.0
14	Maximum width at bottom of ditch ²	feet 25	25	8	10
15	Maximum of average depths of outlet ditches ²	feet 12.0	10.0	9.0	12.0
16	Mean depth of branch ditches ²	feet 6.3	5.0	4.0	7.0
17	Tile drains:				
18	Completed.....	miles 50.7	0.8	1.1	48.8
19	Additional under construction.....	miles 36.2	.....	3.8	32.4
20	Maximum completed in any enterprise.....	miles 48.8	0.8	3.8	48.8
21	Maximum size of tile ²	inches 24	24	20	20
22	Area drained by open ditches only ²	acres 42,082	13,350	5,000	23,732
23	Length of these ditches.....	miles 79.4	45.7	8.5	25.2
24	Average length per acre.....	feet 10.0	18.1	9.0	5.6
25	Area drained by open ditches and tile ²	acres ³ 126,000	1,000	101,000	24,000
26	Length of these drains.....	miles 110.9	0.8	12.9	97.2
27	Average length per acre.....	feet 4.0	4.2	0.7	21.4
DEVELOPMENT OF LAND.					
28	Improved land in operating enterprises, 1920.....	acres 141,252	9,150	89,170	42,932
29	Improved land prior to drainage.....	acres 107,645	3,000	83,410	21,235
30	Increase since drainage.....	acres 33,607	6,150	5,760	21,697
31	Per cent of increase.....	31.2	205.0	6.9	102.2
32	Per cent increase is of all improved land in farms, 1920.....	0.3	1.8	0.6	6.5
33	Unimproved land, 1920.....	acres 27,430	5,200	17,430	4,800
34	Unimproved land prior to drainage.....	acres 61,037	11,350	23,190	26,497
35	Decrease since drainage.....	acres 33,607	6,150	5,760	21,697
36	Per cent of decrease.....	55.1	54.2	24.8	81.9
37	Swampy, subject to overflow, seeped, or alkali land, 1920.....	acres 19,630	800	17,430	1,400
38	Swampy, subject to overflow, etc., prior to drainage.....	acres 55,470	12,683	23,190	19,697
39	Decrease since drainage.....	acres 35,840	11,883	5,760	18,197
40	Per cent of decrease.....	64.6	93.7	24.8	92.9
CAPITAL INVESTED AND COST PER ACRE.					
41	Total capital invested in and required for completion of operating enterprises.....	dollars 846,466	149,766	209,885	486,815
42	Capital invested in these enterprises to Dec. 31, 1919.....	dollars 664,990	149,766	105,842	409,382
43	Additional capital required to complete these enterprises.....	dollars 181,476	.....	104,043	77,433
44	Average cost per acre when completed.....	dollars 5.02	10.44	1.97	10.20
45	Enterprises constructing open ditches only.....	dollars 314,400	146,766	4,250	163,384
46	Average cost per acre when completed.....	dollars 7.47	10.99	0.85	6.83
47	Enterprises constructing open ditches and tile drains ⁴	dollars 532,066	3,000	205,635	323,431
48	Average cost per acre when completed.....	dollars 4.20	3.00	2.02	13.48
CROPS.					
49	Improved land in enterprises reporting—				
50	Wheat as principal crop on drained land.....	acres 107,142	.....	83,410	23,732
51	Alfalfa as principal crop on drained land.....	acres 20,800	.....	1,600	19,200
52	Hay (except alfalfa) as principal crop on drained land.....	acres 12,310	8,150	4,160	.....
53	Other grain as principal crop on drained land.....	acres 1,000	1,000	.....	.....

¹ No timber or cut-over land reported.² When works under construction have been completed.³ Includes 1,000 acres drained by tile only.⁴ Includes 1 enterprise drained by tile only.

FOURTEENTH CENSUS OF THE UNITED STATES: 1920

DEPARTMENT
OF COMMERCE

BULLETIN

BUREAU OF
THE CENSUS

DRAINAGE : NEBRASKA

STATISTICS FOR THE STATE AND ITS COUNTIES

Prepared under the supervision of WILLIAM LANE AUSTIN, Chief Statistician for Agriculture, by ROGER D. MARSDEN, Special Agent in Charge of Drainage

CONTENTS.

	Page.		Page
INTRODUCTION.....	1	DRAINAGE ENTERPRISES—Continued.	
MAP SHOWING OPERATING DRAINAGE ENTERPRISES.....	2	Size of enterprises.....	4
DRAINAGE ON FARMS.....	3	Character of enterprises.....	5
Explanation of terms.....	3	Drainage works.....	6
Farms and farm land.....	3	Maintenance of works.....	7
DRAINAGE ENTERPRISES.....	3	Date of organization.....	7
Explanation of terms.....	3	Crops.....	8
Operating and nonoperating enterprises.....	4	COUNTY TABLES:	
Location of enterprises.....	4	I.—Drainage on farms: 1920.....	8
Condition of land in enterprises.....	4	II.—Operating drainage enterprises: 1920.....	10

INTRODUCTION.

This bulletin presents the statistics of drainage for Nebraska collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of unimproved land not yet in farms. The statistics

for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

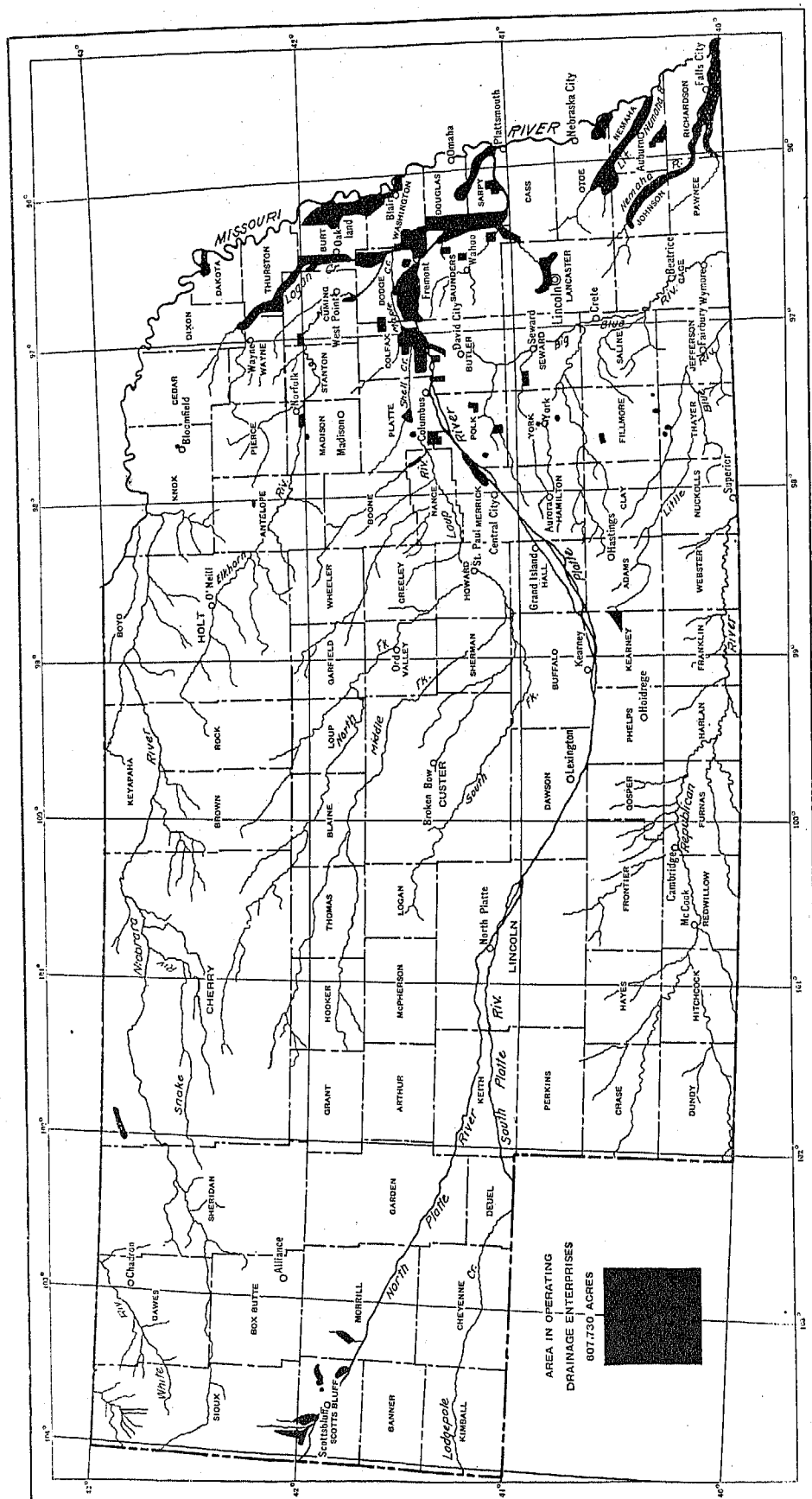
TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
DRAINAGE ON FARMS.		
Number of all farms in the state.....	124,417	100.0
Farms reporting land having drainage.....	2,356	1.9
Farms reporting land needing drainage.....	2,963	2.4
All land in farms..... acres.....	42,225,475	100.0
Improved land in farms..... acres.....	23,109,624	54.7
Farm land reported as provided with drainage..... acres.....	214,428	0.5
Farm land reported as needing drainage..... acres.....	145,818	0.3
DRAINAGE ENTERPRISES.		
Approximate land area of the state..... acres.....	49,157,120	100.0
All land in operating drainage enterprises..... acres.....	607,730	1.2
Improved land..... acres.....	551,517	1.1
Timber and cut-over land..... acres.....	6,342	(¹)
Other unimproved land..... acres.....	49,871	0.1
Capital invested in and required for completion of operating enterprises..	\$4,886,681	100.0
Capital invested in these enterprises to Dec. 31, 1919.....	\$4,588,578	93.9
Additional capital required to complete these enterprises.....	\$298,103	6.1

¹ Less than one-tenth of 1 per cent.

NEBRASKA

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



DRAINAGE ON FARMS.

Explanation of terms.—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which are substantially as follows:

Drainage of agricultural land was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purpose of improving the condition of the soil and crops.

The area provided with drainage, in farms, is the acreage actually benefited or made of more value for agricultural purposes by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land not now suitable for crops which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators have answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual." Levee districts, however, generally are not included in the enterprises for which data are given in this bulletin (see definition of drainage enterprises, below).

Farms and farm land.—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for growing crops by reason of the drainage. This is to be distinguished from the area merely provided with outlet facilities by organized drainage enterprises. Drainage on farms represents in most cases the result of work done by the farm owner, either independently or supplemental to the work done by a drainage enterprise, but the acreage would include also any farm land receiving similar benefits directly from the works of an enterprise.

DRAINAGE ENTERPRISES.

Explanation of terms.—The more important terms used in connection with the census of drainage enterprises were defined as follows:

Drainage enterprises comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swamp or overflowed land for sale, other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditches or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise, though the capacities of drainage pumping plants are given only in the counties in which the plants are located.

Operating enterprises, as designated in this bulletin, are those that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

Land in drainage enterprises comprises the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises, deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (a) improved land; (b) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (c) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be considerably greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprises.

Timber and cut-over land includes farm woodland of natural or

planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, land subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering loss of crops is intended to include only land devoted to planted crops which suffer damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A pumping district is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertakings, and let contracts for the construction work, and also districts that had just been established by court decree and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. ¹		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	633,566	100.0	\$4,588,578	100.0	\$821,811
Operating enterprises.....	607,730	95.9	4,588,578	100.0	208,103
With works completed.....	563,222	89.2	4,121,486	89.8	.....
With works under construction.	42,508	6.7	467,092	10.2	208,103
Nonoperating enterprises.....	25,836	4.1	.....	.....	523,738

¹ The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—The greater part of the drainage enterprises in Nebraska are situated in the eastern quarter of the state, in the counties bordering or near the Platte and Missouri Rivers. In the central and western sections there is very little land organized in drainage enterprises except a few undertakings on the North Platte in the extreme west end of the state.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises...	633,566	100.0	\$4,588,578	100.0	\$821,811
Operating enterprises.....	607,730	95.9	4,588,578	100.0	208,103
Missouri River.....	205,432	32.4	2,529,479	55.1	.....
Kansas River.....	9,260	1.5	41,570	0.9	.....
Platte River.....	393,038	62.0	2,017,529	44.0	208,103
Nonoperating enterprises.....	25,836	4.1	.....	.....	523,738
Missouri River.....	12,504	2.0	.....	.....	377,038
Kansas River.....	3,152	0.5	.....	.....	10,700
Platte River.....	10,180	1.6	.....	.....	136,000

Condition of land in enterprises.—About half the total number of the drainage enterprises, comprising a considerably greater portion of the total area in the enterprises, are reported as organized to obtain relief from overflow. Nearly an equal number of smaller enterprises are reported as needing drainage to relieve a generally wet or swampy condition that made cultivation impossible or unprofitable. The enterprises in the west end of the state are for the drainage of land injured by seepage or water-logging as a result of irrigation.

For the state, 78,312 acres of irrigated land were reported as not having needed drainage but as having been assessed as being responsible for injury to the other land. This acreage is omitted from the statistics given in this bulletin.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflows for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy, seeped, or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	607,730	100.0	565,222	42,508	25,836
Improved land.....	551,517	90.8	514,438	37,070	5,853
Timber and cut-over land.....	6,342	1.0	6,342		207
Other unimproved land.....	49,871	8.2	44,442	5,429	10,716
Swampy, seeped, or subject to overflow.....	14,019	2.3	10,016	3,403	21,630
Suffering a loss of crops.....	10,575	3.2	10,751	2,824	4,700

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way 123 operating drainage enterprises are counted in Nebraska, with an average area of 5,760 acres assessed. Of this number, 16 comprise 10,000 acres or more each, 63 comprise 1,000 to 5,000 acres, and 5 are smaller than 500 acres each. The assessed acreage exceeds the land in enterprises by 100,720 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed area, the net amount of overlapping with enterprises organized previously was deducted, to determine the area to be tabulated as land in enterprises.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

AREA ASSESSED.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	607,730	708,450	100.0
Less than 200 acres.....	320	320	(¹)
200 to 499 acres.....	760	1,200	0.2
500 to 999 acres.....	14,570	14,570	2.1
1,000 to 4,999 acres.....	143,052	173,192	24.4
5,000 to 9,999 acres.....	110,106	115,106	16.2
10,000 to 49,999 acres.....	210,422	275,562	38.9
50,000 acres and over.....	128,500	128,500	18.1

¹Less than one-tenth of 1 per cent.

Character of enterprises.—The drainage enterprises of Nebraska are county drains and drainage districts organized under the general drainage laws of the state, irrigation projects of the United States Reclamation Service, and some drainage undertakings by private owners. The present drainage laws form chapter 19 of the Revised Statutes of Nebraska, 1913, as amended.

The state board of irrigation, highways, and drainage was given jurisdiction in drainage matters, and the act of April 1, 1913 (ch. 25), required that all plans for proposed drainage districts should be approved by that board before contract was let or construction begun. The board was authorized, upon request, to prepare and to furnish at cost plans and specifications for any proposed drainage work. The same provisions are contained in the act of April 19, 1919 (ch. 190), adopting a Civil Administrative Code, by which a department of public works was created and given the powers previously vested in the state board of irrigation, highways, and drainage.

County drains are established under laws of February 28, 1881 (ch. 51), and April 10, 1911 (ch. 140). The later act repealed and reenacted much of the earlier law, but the following provisions are practically alike in both. The drains are established by orders of the county boards of the counties in which the enterprises are located. Upon petition from one or more owners of land to be benefited, the county board investigates the practicability and public utility of a proposed improvement. If they find for the project, the county surveyor or an engineer makes surveys, plans, and estimates for the work and apportions a number of linear feet of drain and cubic yards of excavation to each parcel of land, road, and railroad according to the benefits that each will receive. At public hearing the board considers the public utility of the enterprise, the practicability of the plan of drainage, the apportionment of the benefits, and the claims for compensation on account of damages. Appeals may be taken to the district court of the county. Construction of the works is secured by contracts let by the county board, and is supervised by an engineer appointed by them. For a drain to be

located in more than one county, the petition must be filed in each of the counties and the county boards act jointly. The cost is assessed against the properties in proportion to the benefits, and collected like general taxes. The act of 1911 authorizes the boards to issue bonds for drainage to be paid in not more than 10 annual installments.

County drains, as here classified, include those established under an act of April 11, 1903 (ch. 115). This act provided for drains to be established in each instance upon petition from one or more owners of the land to be drained. Each enterprise was established and controlled by a drainage board consisting of one member selected by the petitioners, one by the county board, and a third by the other two. The assessments of benefits and of damages were made by the drainage board, who also let contracts for construction. The cost was apportioned according to benefits, and each landowner might pay his part in labor. This statute was repealed by act of April 8, 1911 (ch. 142), which provides for establishment and control of these drains by the county board, therein designated as the drainage supervisors, instead of by a separate drainage board for each enterprise. Damages and benefits are to be assessed by three appraisers appointed by the supervisors. No enterprises were reported under the act of 1911.

Drainage districts have been organized under laws of April 2, 1903 (ch. 116), March 29, 1905 (ch. 161), and March 27, 1907 (ch. 153). The act of 1905 repealed that of 1903, to which it was similar, each authorizing the formation of drainage districts by proceedings before the district courts of the counties in which the proposed drainage districts are situated. Articles of association must be signed by a majority in interest of the owners of any contiguous body of swamp or overflowed land, and filed with the district court of the county containing the greatest part of the drainage district. The court may establish the district after public hearing, and exclude any land that will not be benefited. The corporate authority of the district is a board of supervisors elected by the landowners voting each in proportion to his acreage. The cost of the drainage is paid in proportion to benefits assessed against private and corporate land, including railroads and public highways, by the engineer employed by the supervisors to plan the drainage improvements. The tract to receive greatest benefits is rated 100 per cent, and the other tracts in proportion. The assessments are subject to confirmation by the supervisors and to further appeal to the district court. Subdistricts within a drainage district may be formed by proceedings similar to those described, upon petition from one or more owners of land that will be benefited. The supervisors of the main district are the officers of the subdistricts.

DRAINAGE—NEBRASKA.

Drainage districts under the law of 1907 (ch. 153) are established by vote of the landowners in each district. A petition for organization must describe the proposed district and be signed by 10 or more owners of land in the district, or by a fourth of the owners when the total number is less than 20. The county board may amend the boundaries of the district and determine the number of directors that will form the executive board of the enterprise. Establishment of the district and election of the directors is determined by a majority vote of the landowners, including private, public, and municipal corporations, each having one vote for each acre of his holdings in the district. The directors determine the plan of drainage, apportion the benefits that will accrue to the various tracts of land, and secure construction of the works. The tract to receive least benefit is rated one, and the others are rated higher in proportion. Determination of benefits may be appealed to the district court of the county. Damages are determined by agreement or by eminent domain proceedings. An act of April 7, 1911 (ch. 145), requires that the plan of drainage and estimate of cost must be approved by vote of the landowners before construction is undertaken, and that no indebtedness shall be incurred in excess of the total estimated cost. After such approval the directors shall not make any changes in the plans that will increase the estimated cost more than 15 per cent. The cost is assessed according to the benefits. Bonds may be issued when the sum needed is \$5,000 or more, to be paid in not more than 20 annual installments. For a district in more than one county, the proceedings are in the county having the largest acreage in the district.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.			
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.	
			Amount.	Per cent of total.		
All organized enterprises.....	633,566	100.0	\$4,588,578	100.0	\$321,841	
Operating enterprises.....	607,730	95.9	4,588,578	100.0	298,103	
County drains.....	195,260	30.8	530,708	11.6	2,000	
Laws of 1881, ch. 51.....	183,380	28.9	400,203	10.7		
Laws of 1903, ch. 115.....	9,480	1.5	35,195	0.8	1,000	
Laws of 1911, ch. 140.....	2,400	0.4	5,400	0.1	1,000	
Drainage districts.....	396,512	62.6	3,549,382	77.4	55,293	
Laws of 1903, ch. 115.....	2,611	0.4	24,000	0.5		
Laws of 1905, ch. 161.....	224,879	35.5	1,611,219	35.1	9,000	
Laws of 1907, ch. 153.....	169,022	26.7	1,914,163	41.7	46,293	
U. S. Reclamation Service.....	8,658	1.4	355,048	7.7	240,810	
Individual ownership ¹	7,270	1.1	153,350	3.3		
Nonoperating enterprises.....	25,836	4.1			523,738	
County drains.....	1,600	0.3			5,600	
Laws of 1911, ch. 140.....	1,600	0.3			5,600	
Drainage districts.....	24,236	3.8			518,138	
Laws of 1905, ch. 161.....	9,776	1.5			330,638	
Laws of 1907, ch. 153.....	14,460	2.3			187,500	

¹ Includes 2 commercial development enterprises.

No enterprises were reported as organized under the drainage law approved February 19, 1877, which

is in effect on the census date. It authorizes the owners of wet or overflowed land to form incorporated companies to secure drainage.

The United States Reclamation Service may provide drainage as needed for any land in its irrigation projects. Each irrigation district organized under the laws of Nebraska is required, by act of April 17, 1915 (ch. 69), to provide drainage for all land within the district that is subirrigated from any cause not the fault of the owner or lessee of the land.

The first general drainage law of Nebraska was passed March 3, 1873. It provided for drainage by the county board on petition from a majority of the resident owners of the land to be affected. The cost was apportioned by the board in proportion to the benefits. This statute was repealed by the act of February 28, 1881 (ch. 51). An act of March 23, 1893 (ch. 39), provided for the establishment of a private drain across the land of an objecting owner by decree of the county court. This act was repealed by that of 1903 (ch. 115), which later was superseded by the one of 1911 (ch. 142).

A considerable number of amendments have been made to the various drainage laws, but those that affect the character of the enterprises as described have been indicated in the foregoing paragraphs.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 734.5 miles of open ditches, 359.4 miles of tile drains, and 26.8 miles of accessory levees; the additional lengths under construction were 18.7 miles of open ditches, 14.2 miles of tile drains, and 2.8 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There are no pumping districts among the drainage enterprises in this state.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.			
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.	
			Amount.	Per cent of total.		
All kinds.....	607,730	100.0	\$4,588,578	100.0	\$298,103	
Open ditches only.....	445,431	73.3	2,980,949	65.0	54,000	
Open ditches and levees.....	138,551	22.8	1,007,231	22.0	3,293	
Tile drains only.....	6,020	1.0	143,000	3.1		
Open ditches and tile drains.....	17,728	2.9	457,398	10.0	240,810	

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of outlet reported for any enterprise in the state and the maximum in each county are shown in line 15 of

County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths 10 feet and greater were omitted because it seemed that they did not represent so well the average depths of outlet provided for all the farms in those districts. To include this group, computed as 10 feet, would make the mean depth for the state 6.4 instead of 6.1 feet.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	607,730	100.0
Less than 3 feet.....	5,120	0.8
3.0 to 3.9 feet.....	29,100	4.8
4.0 to 4.9 feet.....	48,101	7.9
5.0 to 5.9 feet.....	173,490	28.5
6.0 to 6.9 feet.....	77,454	12.7
7.0 to 7.9 feet.....	39,628	6.5
8.0 to 8.9 feet.....	31,431	5.2
9.0 to 9.9 feet.....	203,496	33.5
10.0 feet and more.....		
Not reporting branches.....		

Maintenance of works.—The county drain law of 1881 (ch. 51), as amended, authorizes the county board to create a county ditch fund, to consist of taxes collected from county levies and of unexpended balances in special ditch funds, to be used for maintenance of the drainage ditches of the county. An act of April 10, 1911 (ch. 141), provides for cleaning out the drains constructed under the law of 1881, by petition and proceedings similar to those prescribed for establishing a new drain. Owners or tenants of land through which runs a watercourse or ditch are required to clean it out at least once each year, between March 1 and April 15, by a law of April 8, 1911 (ch. 143).

The supervisors of each drainage district organized under the act of 1905 (ch. 161) are authorized to keep the works of the district in repair, and for defraying the cost may levy assessments against the land apportioned like the cost of original construction. The directors of districts organized under the act of 1907 (ch. 153) may maintain the drainage works of the enterprise, and assessments therefor are apportioned according to the benefits determined for constructing the works.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	607,730	100.0	\$4,588,578	100.0	\$298,103
By district forces.....	192,160	31.6	1,943,893	42.4	249,103
By contract.....	189,306	27.9	849,474	18.5	22,000
By method not specified.....	11,651	1.9	51,260	1.1	
No maintenance provided.....	230,043	37.9	1,734,330	37.8	25,000
Not reported.....	4,570	0.8	9,681	0.2	1,000

Date of organization.—The progress in drainage is shown only roughly by the dates of the organization of enterprises, which are the dates when the drains or districts were established by the county boards or the district courts, since there may be a period of one or more years between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	607,730	100.0	708,450	100.0
1800 to 1889.....	20,940	3.4	20,940	3.0
1890 to 1899.....	90,862	15.9	100,762	14.2
1900 to 1904.....	34,095	5.6	55,907	7.9
1905 to 1909.....	271,626	44.7	282,646	39.9
1910 to 1914.....	109,420	18.0	172,908	24.4
1915 to 1919.....	75,287	12.4	75,287	10.6

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$4,588,578	100.0	\$298,103
1880 to 1889.....	36,992	0.8	
1890 to 1899.....	189,831	4.1	
1900 to 1904.....	201,704	4.4	
1905 to 1909.....	2,238,344	48.8	285,810
1910 to 1914.....	1,440,754	31.4	2,000
1915 to 1919.....	480,953	10.5	10,293

DRAINAGE—NEBRASKA.

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.	753.2	100.0	373.6	100.0	29.6	100.0
1880 to 1889.....	33.6	4.5	.....	.....	1.5	5.1
1890 to 1899.....	77.0	10.2	.....	.....	.....	.....
1900 to 1904.....	35.3	4.7	1.7	0.5	.....	.....
1905 to 1909.....	324.6	43.1	124.7	33.4	13.1	44.3
1910 to 1914.....	179.8	23.9	246.7	66.0	14.5	49.0
1915 to 1919.....	102.9	13.7	0.5	0.1	0.5	1.7

Crops.—The principal crops grown upon the drained land in drainage enterprises are corn, small grains, and sugar beets. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

	THE STATE.	Burt.	Butler.	Cass.	Cedar.	Cherry.	Clay.	Colfax.
1 Number of all farms in the state or county.....	124,417	1,417	1,850	1,046	2,004	1,004	1,701	1,392
2 Farms reporting land having drainage.....	2,356	183	61	35	59	70	85	100
3 Farms reporting land needing drainage.....	2,963	166	43	82	50	89	105	29
4 Farms in drainage and levee districts.....	1,064	104	34	3	2	6	11	80
LAND AND FARM AREA.								
5 Approximate land area of the state or county..... acres..	49,157,120	304,000	373,120	344,320	470,400	3,826,500	370,500	269,200
6 All land in farms..... acres..	42,225,475	263,631	352,176	319,177	430,452	2,981,085	351,436	251,405
7 Improved land in farms..... acres..	23,109,624	245,739	319,428	280,706	367,547	501,881	313,843	210,476
8 Woodland in farms..... acres..	900,933	7,534	6,658	22,244	11,732	13,023	6,012	3,044
9 Other unimproved land in farms..... acres..	18,214,918	10,358	26,090	16,227	51,173	2,370,781	31,581	28,882
10 Farm land reported as provided with drainage..... acres..	214,428	17,489	5,409	977	2,469	21,075	897	7,841
11 Farm land reported as needing drainage..... acres..	145,813	9,278	808	1,782	2,802	12,081	3,005	3,423
12 Drainage only..... acres..	115,425	6,566	781	384	2,432	12,246	3,487	700
13 Drainage and clearing..... acres..	30,393	2,712	27	1,398	400	435	118	2,033
	Cuming.	Custer.	Dakota.	Dawson.	Dixon.	Dodge.	Douglas.	Fillmore.
1 Number of all farms in the county.....	1,859	3,708	740	1,934	1,441	1,794	1,709	1,075
2 Farms reporting land having drainage.....	65	3	28	18	70	197	38	38
3 Farms reporting land needing drainage.....	71	8	26	37	48	95	102	152
4 Farms in drainage and levee districts.....	26	.....	15	6	2	131	33	20
LAND AND FARM AREA.								
5 Approximate land area of the county..... acres..	369,280	1,056,320	161,020	630,400	302,080	339,840	211,840	368,040
6 All land in farms..... acres..	359,527	1,405,065	141,850	570,874	274,089	322,428	174,418	350,689
7 Improved land in farms..... acres..	318,176	766,939	117,892	377,185	235,274	208,238	157,327	310,880
8 Woodland in farms..... acres..	10,218	25,709	10,604	5,313	15,382	9,273	8,674	3,660
9 Other unimproved land in farms..... acres..	31,133	702,447	13,303	188,376	24,033	14,017	8,417	27,640
10 Farm land reported as provided with drainage..... acres..	3,084	1,720	2,727	1,549	2,454	17,032	2,172	4,250
11 Farm land reported as needing drainage..... acres..	3,779	254	582	1,767	1,902	4,809	2,430	3,060
12 Drainage only..... acres..	2,884	154	303	1,525	1,588	3,765	1,130	3,241
13 Drainage and clearing..... acres..	895	100	214	242	314	1,104	1,207	719
	Garden.	Garfield.	Grant.	Hall.	Hamilton.	Holt.	Howard.	Jefferson.
1 Number of all farms in the county.....	714	490	151	1,556	1,882	2,268	1,523	1,827
2 Farms reporting land having drainage.....	3	33	16	14	24	118	19	5
3 Farms reporting land needing drainage.....	3	33	29	26	61	113	32	87
4 Farms in drainage and levee districts.....	1	2	12	.....	11	8	.....	.....
LAND AND FARM AREA.								
5 Approximate land area of the county..... acres..	1,079,680	368,000	409,200	337,020	344,320	1,531,520	359,040	369,920
6 All land in farms..... acres..	884,328	313,130	561,794	313,008	338,187	1,335,144	347,125	351,184
7 Improved land in farms..... acres..	226,316	110,295	59,823	269,461	305,769	741,869	238,357	260,031
8 Woodland in farms..... acres..	213	7,236	2,234	5,616	1,061	34,769	5,584	14,387
9 Other unimproved land in farms..... acres..	657,799	195,608	499,737	37,931	30,457	558,606	109,184	70,166
10 Farm land reported as provided with drainage..... acres..	530	5,213	12,729	594	1,063	18,703	893	1,917
11 Farm land reported as needing drainage..... acres..	325	3,116	8,190	682	1,804	10,080	1,080	1,935
12 Drainage only..... acres..	325	2,065	8,100	663	1,212	14,768	1,035	145
13 Drainage and clearing..... acres..	.....	151	.....	19	92	1,318	45	1,790

DRAINAGE—NEBRASKA.

9

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

	Johnson.	Keith.	Lancaster.	Lincoln.	Madison.	Merrick.	Nance.	Nemaha.
1 Number of all farms in the county.....	1,187	673	3,259	2,024	1,647	1,364	1,102	1,524
2 Farms reporting land having drainage.....	65	12	67	36	41	72	13	73
3 Farms reporting land needing drainage.....	12	10	69	51	58	40	19	42
4 Farms in drainage and levee districts.....	54	11	30	20	9	57	9	42
LAND AND FARM AREA.								
5 Approximate land area of the county.....acres..	239,360	683,520	545,920	1,623,040	368,640	296,320	285,440	248,960
6 All land in farms.....acres..	206,424	614,842	507,636	1,383,879	323,335	274,940	257,080	237,021
7 Improved land in farms.....acres..	188,081	218,703	449,223	512,778	280,880	223,436	195,969	209,709
8 Woodland in farms.....acres..	11,483	2,641	13,638	11,802	9,155	7,677	9,323	18,661
9 Other unimproved land in farms.....acres..	6,880	393,498	44,775	859,299	33,300	43,827	51,788	8,661
10 Farm land reported as provided with drainage.....acres..	5,526	888	3,742	3,542	2,262	7,935	1,555	5,560
11 Farm land reported as needing drainage.....acres..	328	401	1,686	4,734	3,398	3,718	550	2,319
12 Drainage only.....acres..	269	401	1,204	4,320	2,296	3,118	245	1,486
13 Drainage and clearing.....acres..	59	.....	482	414	1,102	600	305	833
	Otoe.	Platte.	Polk.	Richardson.	Rock.	Sarpy.	Saunders.	Scotts Bluff.
1 Number of all farms in the county.....	2,253	2,131	1,478	1,974	553	979	2,697	1,391
2 Farms reporting land having drainage.....	225	12	14	32	14	31	32	35
3 Farms reporting land needing drainage.....	183	6	22	41	19	42	65	68
4 Farms in drainage and levee districts.....	94	3	12	18	.....	31	24	24
LAND AND FARM AREA.								
5 Approximate land area of the county.....acres..	387,840	430,720	275,200	348,800	642,560	153,600	483,840	462,720
6 All land in farms.....acres..	375,290	413,744	293,937	319,820	461,064	136,114	453,228	281,492
7 Improved land in farms.....acres..	330,878	366,247	234,127	262,030	193,729	120,894	413,568	157,176
8 Woodland in farms.....acres..	21,262	13,746	6,543	25,268	6,885	9,496	11,195	5,446
9 Other unimproved land in farms.....acres..	17,150	33,751	20,207	32,522	260,450	5,724	33,465	118,870
10 Farm land reported as provided with drainage.....acres..	10,967	504	815	2,209	5,436	1,885	1,279	3,419
11 Farm land reported as needing drainage.....acres..	2,851	120	540	1,802	1,609	1,864	2,223	4,251
12 Drainage only.....acres..	1,948	115	503	866	652	1,181	1,613	3,946
13 Drainage and clearing.....acres..	903	5	37	946	957	683	610	305
	Seward.	Sheridan.	Thurston.	Washington.	Wayne.	Webster.	York.	All other counties. ¹
1 Number of all farms in the county.....	2,130	1,063	1,105	1,488	1,287	1,530	2,042	49,868
2 Farms reporting land having drainage.....	37	9	38	51	24	7	42	112
3 Farms reporting land needing drainage.....	71	4	33	71	9	8	114	411
4 Farms in drainage and levee districts.....	16	1	19	31	.....	5	15	37
LAND AND FARM AREA.								
5 Approximate land area of the county.....acres..	367,360	1,580,160	247,680	243,200	288,000	360,920	368,000	23,338,240
6 All land in farms.....acres..	345,869	1,339,444	190,529	229,626	248,107	341,204	346,540	19,582,470
7 Improved land in farms.....acres..	305,923	309,624	177,374	204,530	239,449	261,886	318,376	9,780,679
8 Woodland in farms.....acres..	11,116	26,468	10,644	14,218	1,669	17,325	5,164	399,059
9 Other unimproved land in farms.....acres..	28,830	1,003,352	2,511	10,578	6,989	62,083	23,000	9,402,732
10 Farm land reported as provided with drainage.....acres..	1,277	1,790	3,832	4,577	1,269	4,726	1,211	3,026
11 Farm land reported as needing drainage.....acres..	1,618	1,336	1,846	2,700	315	813	2,925	16,135
12 Drainage only.....acres..	1,397	1,336	370	2,205	315	678	2,901	11,417
13 Drainage and clearing.....acres..	221	.....	1,476	495	.....	135	24	3,718

¹ No drainage on farms reported in Arthur, Banner, Boone, Chase, Cheyenne, Dawes, Deuel, Harlan, Hayes, Hooker, Kimball, Loup, Morrill, Phelps, Pierce, Thomas, and Wheeler Counties.

DRAINAGE—NEBRASKA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Burt.	Butler.	Colfax.	Cuming.	Dakota.	Dodge.	Douglas.
LAND AREA.									
1	Approximate land area of the state or county.....	acres.. 49,157,120	804,000	373,120	259,200	369,290	161,920	339,840	211,840
2	All land in operating drainage enterprises.....	acres.. 607,730	78,992	10,840	46,340	11,100	7,800	122,760	49,260
3	Improved land.....	acres.. 551,517	60,161	10,840	41,830	8,100	6,570	122,440	48,350
4	Per cent of all improved land in farms.....	2.4	24.5	3.4	19.1	2.5	6.6	41.1	30.7
5	Timber and cut-over land.....	acres.. 6,342						320	990
6	Other unimproved land.....	acres.. 49,871	18,831		4,480	3,000	730		
7	Swampy, seeped, or subject to overflow, in enterprises.....	acres.. 14,019	494						
8	Suffering loss of crops from defective drainage.....	acres.. 19,675	4,021		100	300	146	2,100	600
9	Assessed acreage.....	acres.. 708,450	170,712	10,840	46,340	11,100	7,800	122,760	49,260
10	Excess over all land in operating enterprises.....	acres.. 100,720	91,720						
DRAINAGE WORKS.									
11	Open ditches: Completed.....	miles.. 734.5	109.8	9.3	30.2	10.8	6.5	77.6	49.2
12	Additional under construction.....	miles.. 18.7	1.0						
13	Maximum completed in any enterprise.....	miles.. 80.0	80.0	3.5	3.5	5.0	6.5	55.0	41.7
14	Maximum width at bottom of ditch ¹	feet.. 100	100	10	20	15	30	20	40
15	Maximum of average depths of outlet ditches ¹	feet.. 18.0	15.0	7.0	12.0	14.0	15.0	12.0	12.0
16	Mean depth of branch ditches ¹	feet.. 6.1	5.2					6.3	6.0
17	Tile drains: Completed.....	miles.. 359.4	152.2					200.0	
18	Additional under construction.....	miles.. 14.2							
19	Maximum completed in any enterprise.....	miles.. 100.0	100.0					90.0	
20	Maximum size of tile ¹	inches.. 48	12					12	
21	Accessory levees and dikes: Completed.....	miles.. 26.8	10.0						
22	Additional under construction.....	miles.. 2.8							
23	Area drained by open ditches only ¹	acres.. 445,431	22,552	10,840	46,340	11,100	7,800	110,640	49,260
24	Length of these ditches.....	miles.. 528.9	28.3	9.3	30.2	10.8	6.5	77.6	49.2
25	Average length per acre.....	feet.. 6.3	6.6	4.5	3.4	5.1	4.7	3.4	5.3
26	Area having open ditches and levees ¹	acres.. 138,551	51,000						
27	Length of these ditches.....	miles.. 177.9	80.0						
28	Average length per acre.....	feet.. 6.8	8.3						
29	Length of the accessory levees.....	miles.. 29.6	10.0						
30	Area drained by tile only ¹	acres.. 6,020	2,400					3,120	
31	Length of these tile.....	miles.. 356.5	150.0					206.0	
32	Average length per acre.....	feet.. 312.7	330.0					348.6	
33	Area drained by open ditches and tile ¹	acres.. 17,728	3,040						
34	Length of these drains.....	miles.. 63.5	4.7						
35	Average length per acre.....	feet.. 18.0	8.2						
DEVELOPMENT OF LAND.									
36	Improved land in operating enterprises, 1920.....	acres.. 551,517	60,161	10,840	41,830	8,100	6,570	122,440	48,350
37	Improved land prior to drainage.....	acres.. 292,021	27,557	5,400	40,160	3,350	5,475	38,900	48,350
38	Increase since drainage.....	acres.. 258,596	32,604	5,440	1,700	4,750	1,095	83,480	
39	Per cent of increase.....	88.5	118.3	100.7	4.2	141.8	20.0	214.3	
40	Per cent increase is of all improved land in farms, 1920.....	1.1	13.3	1.7	0.8	1.5	0.9	28.0	
41	Timber and cut-over land, 1920.....	acres.. 6,342						320	990
42	Timber and cut-over land prior to drainage.....	acres.. 8,797						320	900
43	Decrease since drainage.....	acres.. 2,455							
44	Per cent of decrease.....	27.9							
45	Other unimproved land, 1920.....	acres.. 49,871	18,831		4,480	3,000	730		
46	Other unimproved land prior to drainage.....	acres.. 306,312	51,435	5,440	6,180	7,750	1,825	83,480	
47	Decrease since drainage.....	acres.. 256,441	32,604	5,440	1,700	4,750	1,095	83,480	
48	Per cent of decrease.....	83.7	63.4	100.0	27.5	61.3	60.0	100.0	
49	Swampy, seeped, or subject to overflow, 1920.....	acres.. 14,019	494						
50	Swampy, seeped, or subject to overflow prior to drainage.....	acres.. 395,253	25,143	8,640	42,308	10,940	5,475	115,248	5,150
51	Decrease since drainage.....	acres.. 381,234	24,649	8,640	42,308	10,940	5,475	115,248	5,150
52	Per cent of decrease.....	96.5	98.0	100.0	100.0	100.0	100.0	100.0	100.0
CAPITAL INVESTED AND COST PER ACRE.									
53	Total capital invested in and required for completion of operating enterprises.....	dollars.. 4,886,681	850,605	62,257	90,092	56,506	196,165	481,075	259,607
54	Capital invested in these enterprises to Dec. 31, 1919.....	dollars.. 4,588,578	825,605	62,257	90,092	56,506	196,165	481,075	259,607
55	Additional capital required to complete these enterprises.....	dollars.. 298,103	25,000						
56	Average cost per acre when completed.....	dollars.. 8.04	10.77	5.74	1.94	5.09	26.87	3.92	5.27
57	Enterprises constructing open ditches only.....	dollars.. 3,034,040	361,335	62,257	90,092	56,506	196,165	308,075	259,607
58	Average cost per acre when completed.....	dollars.. 6.81	16.02	5.74	1.94	5.09	26.87	3.33	5.27
59	Enterprises constructing open ditches and levees.....	dollars.. 1,010,524	428,037						
60	Average cost per acre when completed.....	dollars.. 7.20	8.33						
61	Enterprises constructing tile drains only.....	dollars.. 143,000	57,500					83,000	
62	Average cost per acre when completed.....	dollars.. 23.75	28.96					26.60	
63	Enterprises constructing open ditches and tile drains.....	dollars.. 698,208	6,733						
64	Average cost per acre when completed.....	dollars.. 39.38	2.21						
CROPS.									
65	Improved land in enterprises reporting—								
66	Corn as principal crop on drained land.....	acres.. 495,683	38,869	10,840	41,860	3,000	6,570	120,440	48,350
67	Small grains as principal crop on drained land.....	acres.. 21,705	21,295						
68	Sugar beets as principal crop on drained land.....	acres.. 21,084							
	Hay as principal crop on drained land.....	acres.. 12,955				5,100		2,000	

¹ When works under construction have been completed.² Includes 4,809 acres reporting vegetables as principal crop on drained land.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Johnson.	Kearney.	Lancaster.	Merrick.	Nemaha.	Otoe.	Pawnee.	Richardson.	
LAND AREA.										
1	Approximate land area of the county.....	acres..	230,360	330,240	545,920	296,320	248,060	387,840	275,840	348,800
2	All land in operating drainage enterprises.....	acres..	18,260	9,000	8,000	13,000	20,134	16,437	5,731	35,838
3	Improved land.....	acres..	18,260	7,650	7,000	12,500	18,121	16,437	5,158	27,581
4	Per cent of all improved land in farms.....		9.7	3.0	1.6	5.6	8.6	4.9	2.5	10.5
5	Timber and cut-over land.....	acres..					2,013			2,269
6	Other unimproved land.....	acres..		1,350	1,000	500		573		5,988
7	Swampy, seeped, or subject to overflow, in enterprises.....	acres..		720						6,577
8	Suffering loss of crops from defective drainage.....	acres..	825	720		1,306				2,235
9	Assessed acreage.....		18,260	9,000	8,000	13,000	20,134	16,437	5,731	35,838
10	Excess over all land in operating enterprises.....	acres..								
DRAINAGE WORKS.										
11	Open ditches:									
12	Completed.....	miles..	30.0	1.3	7.0	6.2	55.0	22.0	14.0	50.5
13	Additional under construction.....	miles..				4.3				
14	Maximum completed in any enterprise.....	miles..	25.0	1.3	5.0	4.2	42.0	20.0	14.0	38.0
15	Maximum width at bottom of ditch.....	feet..	28	45	12	5	30	28	12	26
16	Maximum of average depths of outlet ditches.....	feet..	15.0	5.0	10.0	5.0	18.0	15.0	18.0	18.0
17	Mean depth of branch ditches.....	feet..	5.0		4.0		7.5	5.0		6.7
18	Tile drains:									
19	Completed.....	miles..								
20	Additional under construction.....	miles..								
21	Maximum completed in any enterprise.....	miles..								
22	Maximum size of tile.....	inches..								
23	Accessory levees and dikes:									
24	Completed.....	miles..	0.5	0.2			1.5			1.3
25	Additional under construction.....	miles..								
26	Area drained by open ditches only.....	acres..	16,500		8,000	13,000	20,134	2,107	5,731	3,677
27	Length of these ditches.....	miles..	25.0		7.0	10.5	55.0	2.0	14.0	8.0
28	Average length per acre.....	feet..	8.0		4.6	4.3	14.4	5.0	12.9	11.5
29	Area having open ditches and levees.....	acres..	1,700	9,000			14,330			32,101
30	Length of these ditches.....	miles..	5.0	1.3			20.0			42.5
31	Average length per acre.....	feet..	15.0	0.8			7.4			7.0
32	Length of the accessory levees.....	miles..	0.5	0.2			1.5			1.3
33	Area drained by tile only.....	acres..								
34	Length of these tile.....	miles..								
35	Average length per acre.....	feet..								
36	Area drained by open ditches and tile.....	acres..								
37	Length of these drains.....	miles..								
38	Average length per acre.....	feet..								
DEVELOPMENT OF LAND.										
39	Improved land in operating enterprises, 1920.....	acres..	18,260	7,650	7,000	12,500	18,121	16,437	5,158	27,581
40	Improved land prior to drainage.....	acres..	10,010	5,400	3,000	12,200	10,068	421	2,865	10,794
41	Increase since drainage.....	acres..	8,250	2,250	4,000	300	8,053	16,016	2,293	16,817
42	Per cent of increase.....		82.4	41.7	133.3	2.5	80.0		80.0	155.2
43	Per cent increase is of all improved land in farms, 1920.....		4.4	0.9	0.9	0.1	3.8	4.8	1.1	6.4
44	Timber and cut-over land, 1920.....	acres..					2,013			2,269
45	Timber and cut-over land prior to drainage.....	acres..	1,650				2,013		573	2,269
46	Decrease since drainage.....	acres..	1,650						573	
47	Per cent of decrease.....		100.0						100.0	
48	Other unimproved land, 1920.....	acres..		1,350	1,000	500			573	5,988
49	Other unimproved land prior to drainage.....	acres..	6,000	3,600	5,000	800	8,053	16,016	2,293	22,805
50	Decrease since drainage.....	acres..	6,000	2,250	4,000	300	8,053	16,016	1,720	16,817
51	Per cent of decrease.....		100.0	62.5	80.0	37.5	100.0	100.0	75.0	73.7
52	Swampy, seeped, or subject to overflow, 1920.....	acres..		720						6,577
53	Swampy, seeped, or subject to overflow prior to drainage.....	acres..	8,360	2,700	3,000	13,000	10,217	16,016	5,731	25,011
54	Decrease since drainage.....	acres..	8,360	1,980	3,000	13,000	10,217	16,016	5,731	18,434
55	Per cent of decrease.....		100.0	73.3	100.0	100.0	100.0	100.0	100.0	73.7
CAPITAL INVESTED AND COST PER ACRE.										
56	Total capital invested in and required for completion of operating enterprises.....	dollars..	208,559	9,000	35,500	10,250	346,000	195,889	60,000	339,124
57	Capital invested in these enterprises to Dec. 31, 1919.....	dollars..	208,559	9,000	35,500	12,250	346,000	195,889	60,000	339,124
58	Additional capital required to complete these enterprises.....	dollars..				7,000				9.46
59	Average cost per acre when completed.....	dollars..	11.42	1.07	4.44	1.48	17.18	11.92	10.47	86.124
60	Enterprises constructing open ditches only.....	dollars..	176,415		35,500	10,250	346,000	3,033	60,000	23.42
61	Average cost per acre when completed.....	dollars..	10.69		4.44	1.48	17.18	1.44	10.47	263,000
62	Enterprises constructing open ditches and levees.....	dollars..	32,144	9,600				192,856		7.87
63	Average cost per acre when completed.....	dollars..	18.26	1.07				13.46		
64	Enterprises constructing tile drains only.....	dollars..								
65	Average cost per acre when completed.....	dollars..								
66	Enterprises constructing open ditches and tile drains.....	dollars..								
67	Average cost per acre when completed.....	dollars..								
CROPS.										
68	Improved land in enterprises reporting—									
69	Corn as principal crop on drained land.....	acres..	18,260	7,650	3,000	12,000	18,121	16,437	5,158	27,581
70	Small grains as principal crop on drained land.....	acres..			4,000					
71	Sugar beets as principal crop on drained land.....	acres..				500				
72	Hay as principal crop on drained land.....	acres..								

1 When works under construction have been completed.

2 Per cent not shown when more than 1,000.

DRAINAGE—NEBRASKA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Sarpy.	Saunders.	Scotts Bluff.	Sioux.	Thurston.	Washington.	Wayne.	Other counties. ¹	
LAND AREA.										
1	Approximate land area of the county.....	acres..	153,600	483,840	462,720	1,315,200	247,680	243,200	288,000	9,484,800
2	All land in operating drainage enterprises.....	acres..	32,850	30,960	16,124	4,344	12,300	25,840	0,240	26,090
3	Improved land.....	acres..	32,050	29,040	14,110	3,904	12,300	22,760	0,240	20,085
4	Per cent of all improved land in farms.....	per cent.	26.5	7.0	9.0	3.6	6.9	11.1	2.6	0.5
5	Timber and cut-over land.....	acres..	200	280	2,014	440	80	3,000	0	280
6	Other unimproved land.....	acres..	600	1,640	2,014	440	80	3,000	0	5,725
7	Swampy, seeped, or subject to overflow, in enterprises.....	acres..	600	708	1,579	2,309	400	400	0	1,280
8	Suffering loss of crops from defective drainage.....	acres..	1,080	708	1,232	87	475	560	0	1,800
9	Assessed acreage.....	acres..	32,850	30,960	16,124	4,344	12,300	34,840	0,240	26,090
10	Excess over all land in operating enterprises.....	acres..						9,000		
DRAINAGE WORKS.										
11	Open ditches:									
12	Completed.....	miles..	54.6	15.9	49.3	5.9	18.0	32.6	3.3	75.5
13	Additional under construction.....	miles..	1.7		8.9	2.8				
14	Maximum completed in any enterprise.....	miles..	22.5	7.5	23.4	5.9	8.0	21.0	3.3	15.0
15	Maximum width at bottom of ditch.....	feet..	40	27	20	20	10	100	15	20
16	Maximum of average depths of outlet ditches.....	feet..	12.0	12.0	9.0	9.0	17.0	12.0	15.0	15.0
17	Mean depth of branch ditches.....	feet..	5.4	4.0	5.7	7.0	8.0	6.6	8.0	6.1
18	Tile drains:									
19	Completed.....	miles..			0.5					0.7
20	Additional under construction.....	miles..			13.0	1.2				
21	Maximum completed in any enterprise.....	miles..			0.5					0.6
22	Maximum size of tile.....	inches..			48					24
23	Accessory levees and dikes:									
24	Completed.....	miles..	2.0	9.8				1.5		
25	Additional under construction.....	miles..	2.5	0.3						
26	Area drained by open ditches only.....	acres..	25,150	9,300	7,780		12,300	24,840	0,240	23,590
27	Length of these ditches.....	miles..	30.3	8.1	25.5		18.0	31.3	3.3	73.0
28	Average length per acre.....	feet..	7.6	4.6	17.3		7.7	6.7	2.8	10.3
29	Area having open ditches and levees.....	acres..	7,700	21,000				1,000		
30	Length of these ditches.....	miles..	20.0	7.8				1.3		
31	Average length per acre.....	feet..	13.7	1.9				6.9		
32	Length of the accessory levees.....	miles..	4.5	10.1				1.5		
33	Area drained by tile only.....	acres..								500
34	Length of these tile.....	miles..								0.5
35	Average length per acre.....	feet..								5.3
36	Area drained by open ditches and tile.....	acres..			8,344	4,344				2,000
37	Length of these drains.....	miles..			40.2	9.0				2.7
38	Average length per acre.....	feet..			20.2	12.0				7.1
DEVELOPMENT OF LAND.										
39	Improved land in operating enterprises, 1920.....	acres..	32,050	29,040	14,110	3,904	12,300	22,760	0,240	20,085
40	Improved land prior to drainage.....	acres..	10,400	15,270	8,015	3,475	5,120	16,340	2,400	6,625
41	Increase since drainage.....	acres..	21,650	13,770	6,095	429	7,180	6,420	3,744	13,460
42	Per cent of increase.....	per cent.	208.2	90.2	58.3	12.3	140.2	30.3	150.0	203.2
43	Per cent increase is of all improved land in farms, 1920.....	per cent.	17.9	3.3	3.3	0.4	4.0	3.1	1.6	0.3
44	Timber and cut-over land, 1920.....	acres..	200	280				80		280
45	Timber and cut-over land prior to drainage.....	acres..	200	280				80		512
46	Decrease since drainage.....	acres..								232
47	Per cent of decrease.....	per cent.								45.3
48	Other unimproved land, 1920.....	acres..	600	1,640	2,014	440				5,725
49	Other unimproved land prior to drainage.....	acres..	22,250	15,270	7,209	860	7,180	3,000		18,053
50	Decrease since drainage.....	acres..	21,650	13,770	5,195	429	7,180	6,420	3,744	13,228
51	Per cent of decrease.....	per cent.	97.3	80.4	72.1	49.4	100.0	68.2	100.0	60.3
52	Swampy, seeped, or subject to overflow, 1920.....	acres..	600		1,579	2,309		400		1,280
53	Swampy, seeped, or subject to overflow prior to drainage.....	acres..	24,250	13,550	5,404	4,344	8,300	18,000	3,744	19,702
54	Decrease since drainage.....	acres..	23,650	13,550	3,885	1,975	8,300	18,560	3,744	18,422
55	Per cent of decrease.....	per cent.	97.5	100.0	71.1	45.5	100.0	97.9	100.0	93.5
CAPITAL INVESTED AND COST PER ACRE.										
56	Total capital invested in and required for completion of operating enterprises.....	dollars..	266,177	58,696	560,800	198,058	180,100	203,874	0,800	201,047
57	Capital invested in these enterprises to Dec. 31, 1919.....	dollars..	262,177	57,403	560,000	118,048	180,100	203,874	0,800	201,047
58	Additional capital required to complete these enterprises.....	dollars..	4,000	1,293	800	80,010				
59	Average cost per acre when completed.....	dollars..	8.10	1.90	34.78	45.59	14.64	7.89	1.09	7.74
60	Enterprises constructing open ditches only.....	dollars..	217,247	18,759	73,000		180,100	194,854	0,800	193,830
61	Average cost per acre when completed.....	dollars..	8.64	2.00	9.38		14.64	7.84	1.09	8.22
62	Enterprises constructing open ditches and levees.....	dollars..	48,930	30,937				0,020		
63	Average cost per acre when completed.....	dollars..	6.35	1.85				0.02		
64	Enterprises constructing tile drains only.....	dollars..								
65	Average cost per acre when completed.....	dollars..								2,500
66	Enterprises constructing open ditches and tile drains.....	dollars..			487,800	198,058				5.00
67	Average cost per acre when completed.....	dollars..			58.46	45.59				5.017
68		dollars..								2.81
CROPS.										
69	Improved land in enterprises reporting—									
70	Corn as principal crop on drained land.....	acres..	32,050	20,040			12,300	22,760	6,240	15,100
71	Small grains as principal crop on drained land.....	acres..								500
72	Sugar beets as principal crop on drained land.....	acres..			10,880	3,904				2,300
73	Hay as principal crop on drained land.....	acres..			3,230					2,125

¹ Includes only Antelope, Cass, Cheyenne, DeWitt, and Fergus counties.

¹ Includes only Antelope, Cass, Cherry, Dixon, Fillmore, Knox, Madison, Morrill, Nance, Platte, Polk, Seward, Thayer, and York Counties.
² When works under construction have been completed.

FOURTEENTH CENSUS OF THE UNITED STATES: 1920

DEPARTMENT
OF COMMERCE

BULLETIN

BUREAU OF
THE CENSUS

DRAINAGE : NORTH CAROLINA

STATISTICS FOR THE STATE AND ITS COUNTIES

Prepared under the supervision of WILLIAM LANE AUSTIN, Chief Statistician for Agriculture, by ROGER D. MARSDEN, Special Agent in Charge of Drainage

CONTENTS.

	Page.		Page.
INTRODUCTION.....	1	DRAINAGE ENTERPRISES—Continued.....	
MAP SHOWING OPERATING DRAINAGE ENTERPRISES.....	2	Size of enterprises.....	4
DRAINAGE ON FARMS.....	3	Character of enterprises.....	5
Explanation of terms.....	3	Drainage works.....	6
Farms and farm land.....	3	Maintenance of works.....	6
DRAINAGE ENTERPRISES.....	3	Date of organization.....	6
Explanation of terms.....	3	Crops.....	7
Operating and nonoperating enterprises.....	4	COUNTY TABLES:	
Location of enterprises.....	4	I.—Drainage on farms: 1920.....	7
Condition of land in enterprises.....	4	II.—Operating drainage enterprises: 1920.....	10

INTRODUCTION.

This bulletin presents the statistics of drainage for North Carolina collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises include considerable areas of timbered and other unimproved land not yet

in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
DRAINAGE ON FARMS.		
Number of all farms in the state.....	269,763	100.0
Farms reporting land having drainage.....	45,246	16.8
Farms reporting land needing drainage.....	42,247	15.7
All land in farms..... acres..	20,021,736	100.0
Improved land in farms..... acres..	8,198,409	40.9
Farm land reported as provided with drainage..... acres..	1,066,933	5.3
Farm land reported as needing drainage..... acres..	1,925,843	9.6
DRAINAGE ENTERPRISES.		
Approximate land area of the state..... acres..	31,193,600	100.0
All land in operating drainage enterprises..... acres..	542,828	1.7
Improved land..... acres..	204,928	0.7
Timber and cut-over land..... acres..	244,576	0.8
Other unimproved land..... acres..	93,324	0.3
Capital invested in and required for completion of operating enterprises..	\$4,526,018	100.0
Capital invested in these enterprises to Dec. 31, 1919.....	\$3,623,518	80.1
Additional capital required to complete these enterprises.....	\$902,500	19.9

(2)

DRAINAGE ON FARMS.

Explanation of terms.—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which are substantially as follows:

Drainage of agricultural land was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purpose of improving the condition of the soil and crops.

The area provided with drainage, in farms, is the acreage actually benefited or made of more value for agricultural purposes by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land not now suitable for crops which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators have answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual." Levee districts, however, generally are not included in the enterprises for which data are given in this bulletin (see definition of drainage enterprises, below).

Farms and farm land.—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for growing crops by reason of the drainage. This is to be distinguished from the area merely provided with outlet facilities by organized drainage enterprises. Drainage on farms represents in most cases the result of work done by the farm owner, either independently or supplemental to the work done by a drainage enterprise, but the acreage would include also any farm land receiving similar benefits directly from the works of an enterprise.

DRAINAGE ENTERPRISES.

Explanation of terms.—The more important terms used in connection with the census of drainage enterprises were defined as follows:

Drainage enterprises comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swamp or overflowed land for sale, other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditches or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise, though the capacities of drainage pumping plants are given only in the counties in which the plants are located.

Operating enterprises, as designated in this bulletin, are those that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

Land in drainage enterprises comprises the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises, deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (a) improved land; (b) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (c) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be considerably greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprises.

Timber and cut-over land includes farm woodland of natural or

planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, land subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering loss of crops is intended to include only land devoted to planted crops which suffer damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A pumping district is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

DRAINAGE—NORTH CAROLINA.

Operating and nonoperating enterprises.—In the tables that follow, statistics are given for operating enterprises only, as no nonoperating drainage enterprises were found in North Carolina. The operating enterprises, as already defined, include both those that have completed their drainage works and those with such works under construction. Among the latter might be any that had completed the original plan of drainage works some years ago but were constructing extensions or enlargements on January 1, 1920.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN WORKS COMPLETED AND WORKS UNDER CONSTRUCTION: 1920.

CLASS.	LAND.		CAPITAL. ¹		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	542,828	100.0	\$3,623,518	100.0	\$902,500
With works completed.....	440,657	81.2	3,075,018	84.9	.....
With works under construction.....	102,171	18.8	548,500	15.1	902,500

¹ The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—The greater part of the land in drainage enterprises in North Carolina is in the northeastern part of the state. Of the total of 542,828 acres, 475,914 acres, or 87.7 per cent, are in the Coastal Plain region, and only 66,914 acres, or 12.3 per cent, are in the Piedmont section. On the peninsula between Albemarle Sound and Pamlico River are 227,482 acres, or 41.9 per cent of the state total.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	542,828	100.0	\$3,623,518	100.0	\$902,500
Pamlico River.....	116,655	21.5	642,600	17.7	440,000
Neuse River.....	28,489	5.3	339,000	9.4	3,000
Cape Fear River.....	72,472	13.4	448,500	12.4	.....
Peedee River.....	59,369	10.9	593,545	16.4	19,500
Santee River.....	46,145	8.5	439,351	12.1	.....
Atlantic Ocean.....	219,688	40.5	1,160,522	32.0	440,000

Condition of land in enterprises.—In the Coastal Plain region the drainage enterprises are for the reclamation of broad areas that are mostly timbered or cut-over swamp land. In the region of Albemarle and Pamlico Sounds much of the land surface is practically flat and only slightly above sea level. In the Piedmont section of the state the drainage problem is that of preventing damage by overflow

from stream floods of short duration, and the enterprises are generally narrow strips forming the overflowed bottom land between the hills.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflow for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.			
	Total.		Works completed (acres).	Works under construction (acres).
	Acreage.	Percent of all land.		
All land in enterprises.....	542,828	100.0	440,657	102,171
Improved land.....	204,928	37.8	198,500	6,419
Timber and cut-over land.....	244,576	45.1	179,934	64,642
Other unimproved land.....	93,324	17.2	62,214	31,110
Swampy or subject to overflow.....	77,494	14.3	25,089	52,405
Suffering a loss of crops.....	12,771	2.4	11,897	874

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided and the part in each county be considered a separate enterprise. In this way 104 drainage enterprises are counted in North Carolina, with an average area of 5,312 acres assessed. The assessed acreage exceeds the land in enterprises by 9,600 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed acreage, deduction was made for the amount of overlapping with enterprises organized previously, to determine the acreage to be tabulated as land in enterprise.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

AREA ASSESSED.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Percent of total.
All operating enterprises.....	542,828	552,428	100.0
Less than 200 acres.....	120	120	(¹)
200 to 499 acres.....	2,997	2,997	0.5
500 to 999 acres.....	15,928	15,928	2.9
1,000 to 4,999 acres.....	93,226	96,026	17.4
5,000 to 9,999 acres.....	64,917	71,717	13.0
10,000 to 49,999 acres.....	265,640	265,640	48.1
50,000 acres and over.....	100,000	100,000	18.1

¹ Less than one-tenth of 1 per cent.

Character of enterprises.—The drainage enterprises in North Carolina comprise drainage districts, county drains, incorporated ditches, commercial land development companies, and private undertakings by individual landowners. The drainage districts, county drains, and incorporated ditches have been established under general laws and local or special acts intended to promote the reclamation and improvement of land that is wet or subject to overflow.

There are 81 drainage districts organized under the general drainage law of March 5, 1909 (ch. 442). Such districts are established by the superior courts of the counties in which they are situated. The petition for establishment must be signed by a majority of the resident landowners or by the owners of three-fifths of the land in the proposed district. Three disinterested viewers are appointed by the clerk of the court to report regarding the practicability of the project and the proper boundaries of the district, which must include no land that will not be benefited. If the report recommends against establishment, the petition is dismissed. After the decree of establishment has been issued the viewers prepare plans for the drainage works, assess damages, and divide the land into five classes according to the benefits that will accrue to the various tracts. Public hearings are held by the clerk of the court upon the viewers' reports, before the district is established and after the assessment of damages and the classification of the lands. From the clerk's determinations regarding damages and classification, appeals may be taken to the superior court. Three drainage commissioners are appointed by the clerk of the court, after being elected by the landowners. The drainage works are constructed by the commissioners, who apportion the cost according to the classification of the land. The five classes are assessed, per acre, in the ratio 5:4:3:2:1. If the average cost is less than 25 cents per acre, the assessments are collected in one installment; if it exceeds 25 cents per acre, the drainage commissioners may issue bonds of the district, payable in 3 to 12 years, in an amount not exceeding the unpaid assessments. Districts in more than one county are under the jurisdiction of the court with which the petition is filed. Subdistricts may be organized within any drainage district, in the same manner as main districts.

A drainage district of 3,000 acres has been formed under the general drainage law of March 6, 1905 (ch. 541). Upon petition from a majority of the owners of land adjacent to and on both sides of the creek or branch the county commissioners declare the district established. Each owner then is required to clean out the watercourse through or abutting his property, or the work will be done and the cost assessed against him. One district of 1,700 acres was created by a special act of the legislature.

The county drains are organized under local laws. All but one of the enterprises in Mecklenburg County have been formed under an act of March 3, 1911 (ch. 538), applying in only that county. The law created a county drainage commission to secure such drainage improvements in the county as might seem advantageous. The land to be benefited by each drain is divided by the commission into five classes, and the cost is assessed in the same manner as provided in the drainage district law of 1909. Hearing on the classification is held by the commission, from whose determinations appeal may be taken to the superior court of the county. Damages for lands condemned are determined as in railroad condemnation cases. Plans for the works are prepared and contracts for construction are let by the commission. Assessments are levied annually until the works are paid for, at not to exceed \$5 per acre. Bonds for drainage work may be issued for the commission, not to exceed \$15,000.

One county drain has been established, to benefit 600 acres, under an act of February 27, 1885 (ch. 149), effective in only Rowan, Davidson, Davie, and Catawba Counties. Upon petition from a majority of the owners of land on any one of the streams in the county, five drainage commissioners are appointed by the county commissioners. The drainage commissioners estimate each owner's acreage that will be affected, and the owners then furnish laborers, each in proportion to his acreage and the wetness of his land, to work under overseers appointed by the commissioners.

Incorporated ditches may be established by the superior courts of the counties, under an act of April 10, 1869 (ch. 164). Petition is filed by a landowner who desires drainage and can secure outlet only across the land of another owner who also will be benefited by the drain. Commissioners are appointed by the court to determine the location and size of the drain and the proportion of cost to be paid by each owner benefited. The drain will not be established if the estimated cost exceeds three-fourths of the value of the land to be benefited, if the lower lands will not be increased 25 per cent in value, or if the owners of one-half in value of the land to be affected do not consent. A statute of 1795, also, provided for any landowner needing to secure drainage outlet across the property of an objecting owner. As amended that law requires a petition to the clerk of the superior court, who will appoint commissioners to assess the damages that the petitioner must pay before he may construct the drain.

Many amendments to the laws enumerated above have been made, but without affecting the forms of the enterprises or the methods of organization as described. A large number of local and special laws have been enacted, for which no enterprises were reported.

DRAINAGE—NORTH CAROLINA.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises ¹	542,828	100.0	\$3,623,518	100.0	\$902,500
Drainage districts.....	458,396	84.4	3,161,317	87.2	484,500
County drains.....	17,724	3.3	113,101	3.1	.....
Incorporated ditches.....	6,857	1.3	34,100	0.9	.....
Commercial developments.....	30,976	5.7	170,000	4.7	415,000
Individual ownerships.....	28,875	5.3	145,000	4.0	3,000

¹ No nonoperating enterprises in the state.

Drainage works.—The total works completed by the drainage enterprises to December 31, 1919, comprised 1,171.3 miles of open ditches and 33.5 miles of accessory levees; the additional lengths under construction were 367.8 miles of ditches only. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises nor the works of flood protection or levee districts that had not undertaken the construction of ditches or tile drains. There is one pumping district for land drainage in North Carolina. All the drainage water from 100,000 acres is removed by 16 centrifugal pumps of 1,000,000 gallons per minute capacity, operated by steam engines capable of developing 1,000 horsepower.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	542,828	100.0	\$3,623,518	100.0	\$902,500
Open ditches only.....	435,295	80.2	2,827,144	78.0	902,500
Open ditches and levees.....	107,533	19.8	796,374	22.0	.....

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches, which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the

occasional decimals were omitted in making these computations. Depths of 10 feet and more were omitted; to include this group, computed as 10 feet, would show the mean depth for the state 7.5 instead of 6.7 feet.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	542,828	100.0
4.0 to 4.9 feet.....	16,380	3.0
5.0 to 5.9 feet.....	41,002	7.6
6.0 to 6.9 feet.....	101,094	18.6
7.0 to 7.9 feet.....	104,795	19.3
8.0 to 8.9 feet.....	44,040	8.3
9.0 to 9.9 feet.....	47,629	8.8
10.0 feet and more.....	105,300	19.4
Not reporting branches.....	81,298	15.0

Maintenance of works.—The law of 1909, as amended, requires that in each drainage district the original assessment for cost of construction shall include an amount estimated to be sufficient for keeping the works in repair for three years. The drainage commissioners are authorized also to levy special assessments for maintenance purposes, apportioned like the cost of construction, whenever deemed necessary by the commissioners. For maintenance of works constructed by the Mecklenburg County Drainage Commission, under the act of 1911, that commission may levy assessments apportioned like those for construction.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	542,828	100.0	\$3,623,518	100.0	\$902,500
By district forces.....	9,406	1.7	147,471	4.1	.....
By contract.....	160,101	29.5	1,090,054	30.1	13,500
By landowners.....	28,810	5.3	299,995	8.3	.....
Method not stated.....	8,350	1.5	79,000	2.2	.....
No maintenance provided.....	295,421	54.4	1,827,998	50.4	514,000
Not reporting.....	40,740	7.5	179,000	4.0	375,000

Date of organization.—The progress of development in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the court or other designated official, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of reclamation was completed.

DRAINAGE—NORTH CAROLINA.

7

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	542,828	100.0	552,428	100.0
Before 1860.....	1,650	0.3	1,650	0.3
1880-1889.....	2,507	0.5	2,507	0.5
1905-1909.....	51,553	9.5	51,553	9.3
1910-1914.....	347,661	64.0	357,261	64.7
1915-1919.....	139,457	25.7	139,457	25.2

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$3,623,518	100.0	\$902,500
Before 1860.....	10,000	0.3	.....
1880-1889.....	10,000	0.3	.....
1905-1909.....	327,500	9.0	.....
1910-1914.....	1,776,767	49.0	.....
1915-1919.....	1,499,251	41.4	902,500

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	1,539.1	100.0	33.5	100.0
Before 1860.....	6.0	0.4	.....	.....
1880-1889.....	5.0	0.3	.....	.....
1905-1909.....	111.7	7.3	2.5	7.5
1910-1914.....	758.6	49.3	31.0	92.5
1915-1919.....	657.8	42.7	.....	.....

Crops.—The principal crops grown upon the drained land in drainage enterprises are corn and cotton. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

	THE STATE.	Ala- man- ce.	Alle- ghany.	Anson.	Ashe.	Beaufort.	Bertie.	Bladen.	
1	Number of all farms in the state or county.....	260,763	2,705	1,409	3,706	3,407	3,228	3,340	2,452
2	Farms reporting land having drainage.....	45,246	65	90	187	515	2,250	1,341	1,223
3	Farms reporting land needing drainage.....	42,247	242	99	592	989	1,739	1,000	1,040
4	Farms in drainage and levee districts.....	1,881	3	.....	9	1	261	2	49
LAND AND FARM AREA.									
5	Approximate land area of the state or county.....acres..	31,193,600	314,880	149,760	355,840	273,280	537,600	440,920	624,640
6	All land in farms.....acres..	20,021,736	239,175	138,908	251,975	200,765	218,828	233,242	239,916
7	Improved land in farms.....acres..	8,198,400	100,776	91,789	112,352	158,951	79,403	87,284	68,177
8	Woodland in farms.....acres..	10,299,547	119,583	45,286	121,717	87,744	134,311	137,446	163,196
9	Other unimproved land in farms.....acres..	1,523,780	18,816	1,833	17,906	14,970	5,114	8,512	18,543
10	Farm land reported as provided with drainage.....acres..	1,066,933	707	715	2,152	3,877	57,455	22,698	30,434
11	Farm land reported as needing drainage.....acres..	1,925,343	1,613	1,114	24,142	23,123	100,164	28,855	71,506
12	Drainage only.....acres..	189,401	89	382	1,408	1,345	1,030	1,779	6,238
13	Drainage and clearing.....acres..	1,735,942	1,524	732	22,734	21,778	99,125	27,076	65,268

	Brun- swick.	Bun- combe.	Burke.	Cabarrus.	Caldwell.	Camden.	Carteret.	Catawba.	Chowan.	
1	Number of all farms in the county.....	1,417	3,701	2,194	2,427	1,972	875	858	2,916	1,028
2	Farms reporting land having drainage.....	592	138	184	113	88	659	102	188	610
3	Farms reporting land needing drainage.....	861	100	197	84	110	206	80	118	386
4	Farms in drainage and levee districts.....	.....	.....	7	3	19	20	.....	28	1
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	505,600	408,900	341,760	249,600	301,440	140,800	366,720	261,120	105,600
6	All land in farms.....acres..	209,959	266,134	195,202	206,903	183,636	52,845	69,464	217,463	77,253
7	Improved land in farms.....acres..	28,554	129,467	58,461	101,873	61,264	35,384	17,304	113,685	33,973
8	Woodland in farms.....acres..	164,810	126,615	117,774	73,906	113,788	17,206	42,139	80,192	41,288
9	Other unimproved land in farms.....acres..	16,595	10,052	18,967	31,124	8,584	255	9,971	23,586	1,992
10	Farm land reported as provided with drainage.....acres..	13,309	2,749	1,652	1,895	893	25,826	4,601	1,554	15,966
11	Farm land reported as needing drainage.....acres..	60,138	3,454	5,474	1,214	2,511	5,674	16,085	627	16,810
12	Drainage only.....acres..	13,878	231	313	786	556	90	4,015	265	681
13	Drainage and clearing.....acres..	52,260	3,223	5,161	428	1,955	5,584	12,070	362	16,129

DRAINAGE—NORTH CAROLINA.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Clay.	Cleve- land.	Colum- bus.	Craven.	Cumber- land.	Curri- tuck.	David- son.	Davis.	Duplin.
1	Number of all farms in the county.....	808	4,016	3,580	2,598	3,100	984	3,770	1,768	4,688
2	Farms reporting land having drainage.....	125	142	2,695	1,134	706	266	504	130	2,538
3	Farms reporting land needing drainage.....	61	112	2,428	532	604	212	609	144	1,453
4	Farms in drainage and levee districts.....		77	37	1	5	13	0	.....	2
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	140,800	317,440	597,120	422,400	428,800	188,880	364,160	165,120	505,600
6	All land in farms.....acres..	71,130	252,539	284,184	149,899	233,840	88,843	311,745	161,713	314,600
7	Improved land in farms.....acres..	24,876	132,425	78,603	59,701	92,196	50,589	128,542	67,690	98,638
8	Woodland in farms.....acres..	40,871	89,431	180,640	72,587	130,864	29,875	130,680	56,856	195,236
9	Other unimproved land in farms.....acres..	5,883	30,683	24,851	17,611	10,780	8,379	52,515	27,167	20,726
10	Farm land reported as provided with drainage.....acres..	987	4,735	58,397	21,782	18,620	15,957	3,873	1,426	54,984
11	Farm land reported as needing drainage.....acres..	386	1,455	130,123	37,428	42,262	7,034	21,191	1,689	89,421
12	Drainage only.....acres..	807	341	10,479	6,424	3,609	185	1,277	755	3,921
13	Drainage and clearing.....acres..	79	1,114	119,644	31,004	38,653	6,849	19,914	931	82,497

		Edge- combe.	Forsyth.	Franklin.	Gaston.	Gates.	Graham.	Gran- ville.	Greene.	Guilford.
1	Number of all farms in the county.....	3,840	2,840	4,226	2,339	1,583	746	3,503	2,740	4,021
2	Farms reporting land having drainage.....	1,765	155	8	148	589	48	87	229	63
3	Farms reporting land needing drainage.....	648	186	429	121	370	75	123	10	172
4	Farms in drainage and levee districts.....	1	23	3	28	4	.....	.....	79	1
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	325,760	240,640	299,520	232,320	229,760	190,720	321,020	161,280	442,240
6	All land in farms.....acres..	256,842	209,604	223,615	178,349	125,075	93,112	298,004	126,754	350,659
7	Improved land in farms.....acres..	138,733	94,389	105,608	87,300	49,140	17,457	112,556	67,447	145,795
8	Woodland in farms.....acres..	108,749	95,255	102,428	63,656	65,778	43,191	151,469	56,056	165,551
9	Other unimproved land in farms.....acres..	9,360	19,960	15,579	27,390	10,157	2,404	34,579	3,251	39,313
10	Farm land reported as provided with drainage.....acres..	61,838	1,437	5,006	1,939	15,488	705	3,598	4,516	837
11	Farm land reported as needing drainage.....acres..	39,539	2,131	18,124	1,901	13,033	924	5,892	208	3,778
12	Drainage only.....acres..	3,488	1,234	592	705	2,079	248	818	140	1,293
13	Drainage and clearing.....acres..	36,051	897	17,632	1,196	10,954	676	5,074	68	2,480

		Halifax.	Harnett.	Hay- wood.	Hender- son.	Hertford.	Hoke.	Hyde.	Iredell.	Jackson.
1	Number of all farms in the county.....	4,671	3,378	2,074	1,973	2,084	1,496	1,148	4,115	1,852
2	Farms reporting land having drainage.....	463	525	89	148	954	237	491	217	108
3	Farms reporting land needing drainage.....	833	1,046	238	93	649	153	201	234	157
4	Farms in drainage and levee districts.....	9	5	.....	.....	1	.....	38	166	.....
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	432,640	376,320	349,440	229,120	218,240	266,880	304,880	376,320	316,160
6	All land in farms.....acres..	334,803	239,749	172,268	148,741	185,516	99,543	80,675	347,747	148,688
7	Improved land in farms.....acres..	152,328	90,947	81,796	53,150	66,289	52,655	37,000	100,738	49,777
8	Woodland in farms.....acres..	155,880	142,809	83,086	67,434	114,476	36,402	32,270	151,888	85,625
9	Other unimproved land in farms.....acres..	26,595	5,990	7,383	28,157	4,752	10,486	11,345	35,121	13,280
10	Farm land reported as provided with drainage.....acres..	17,634	6,221	781	3,207	13,633	4,117	15,697	2,461	632
11	Farm land reported as needing drainage.....acres..	46,832	46,046	8,108	1,948	24,285	5,937	75,265	2,564	5,446
12	Drainage only.....acres..	4,490	1,490	273	573	387	337	60,117	1,246	297
13	Drainage and clearing.....acres..	42,342	45,237	7,835	1,375	23,898	5,600	25,148	1,318	5,149

		Johnston.	Jones.	Lee.	Lenoir.	Madison.	Martin.	Mecklen- burg.	Moore.	Nash.
1	Number of all farms in the county.....	7,026	1,540	1,465	3,162	2,935	2,515	4,344	2,176	4,451
2	Farms reporting land having drainage.....	1,267	62	85	1,502	107	274	183	97	322
3	Farms reporting land needing drainage.....	1,315	67	260	546	82	203	600	158	485
4	Farms in drainage and levee districts.....	2	.....	.....	11	.....	1	24	.....	13
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	516,480	266,880	167,040	249,600	279,040	280,320	382,080	408,960	375,040
6	All land in farms.....acres..	396,438	156,634	121,006	189,153	213,290	191,404	288,105	229,597	241,948
7	Improved land in farms.....acres..	177,433	52,808	37,077	90,322	106,249	79,360	151,447	57,820	108,272
8	Woodland in farms.....acres..	212,552	97,692	80,793	93,247	97,260	106,055	90,898	161,799	126,110
9	Other unimproved land in farms.....acres..	6,453	6,074	3,130	5,584	9,781	5,989	45,760	9,978	7,557
10	Farm land reported as provided with drainage.....acres..	16,649	1,648	746	47,556	685	14,076	2,115	779	8,797
11	Farm land reported as needing drainage.....acres..	43,718	6,949	16,891	28,894	1,266	18,392	10,036	10,052	17,094
12	Drainage only.....acres..	2,988	241	533	8,663	55	4,655	2,015	388	694
13	Drainage and clearing.....acres..	40,730	6,708	16,358	20,141	1,211	14,237	8,021	9,664	16,400

DRAINAGE—NORTH CAROLINA.

9

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

	New Hanover.	North- ampton.	Onslow.	Pamlico.	Pasquo- tank.	Pender.	Perqui- mans.	Pitt.	Ran- dolph.
1 Number of all farms in the county.....	323	3,501	2,179	1,316	1,360	1,886	1,462	5,937	3,871
2 Farms reporting land having drainage.....	60	1,128	740	811	730	349	778	2,022	63
3 Farms reporting land needing drainage.....	84	358	412	450	188	705	289	1,124	394
4 Farms in drainage and levee districts.....	1	5	.....	344	.....	10	8	27	.....
LAND AND FARM AREA.									
5 Approximate land area of the county..... acres..	138,240	322,560	475,520	224,000	142,720	521,600	161,280	401,280	513,920
6 All land in farms..... acres..	17,926	222,418	193,176	85,382	84,469	178,931	86,360	293,062	405,320
7 Improved land in farms..... acres..	6,137	104,841	54,196	35,170	51,065	44,003	48,403	146,327	132,242
8 Woodland in farms..... acres..	9,804	105,150	133,804	42,169	29,878	128,585	37,222	137,350	242,732
9 Other unimproved land in farms..... acres..	1,925	12,421	5,176	8,043	3,526	6,393	675	9,385	30,346
10 Farm land reported as provided with drainage..... acres..	1,244	21,526	15,650	20,213	26,709	10,240	24,847	52,706	773
11 Farm land reported as needing drainage..... acres..	2,966	11,479	20,403	22,936	9,147	54,311	8,972	63,627	20,498
12 Drainage only..... acres..	216	1,591	413	111	156	1,452	88	3,057	488
13 Drainage and clearing..... acres..	2,780	9,888	20,050	22,825	8,991	52,859	8,884	60,570	20,010

	Rich- mond.	Robeson.	Rowan.	Sampson.	Scotland.	Stanly.	Transyl- vania.	Tyrrell.	Union.
1 Number of all farms in the county.....	1,797	6,564	3,474	5,771	1,830	2,510	799	643	4,820
2 Farms reporting land having drainage.....	25	2,080	268	1,806	659	211	184	257	564
3 Farms reporting land needing drainage.....	215	1,841	219	2,264	191	83	65	152	1,093
4 Farms in drainage and levee districts.....	1	97	103	1	.....	2	.....	164	.....
LAND AND FARM AREA.									
5 Approximate land area of the county..... acres..	333,440	633,600	312,960	567,040	223,360	266,240	242,560	240,600	361,600
6 All land in farms..... acres..	164,521	400,228	290,408	427,493	114,942	207,205	69,984	51,440	347,939
7 Improved land in farms..... acres..	77,593	209,367	145,063	148,807	75,822	87,549	19,383	18,610	156,443
8 Woodland in farms..... acres..	76,519	161,363	118,042	257,240	35,112	103,191	43,283	34,910	160,533
9 Other unimproved land in farms..... acres..	10,409	29,498	33,303	21,380	4,008	16,465	7,318	920	30,963
10 Farm land reported as provided with drainage..... acres..	589	93,052	2,136	36,346	18,931	10,432	4,893	5,762	9,732
11 Farm land reported as needing drainage..... acres..	11,196	89,045	4,174	123,085	11,810	2,222	1,956	4,516	35,808
12 Drainage only..... acres..	342	6,570	759	6,437	756	685	843	411	3,451
13 Drainage and clearing..... acres..	10,854	82,475	3,415	116,648	11,054	1,537	1,143	4,105	32,357

	Warren.	Washing- ton.	Watauga.	Wayne.	Wilkes.	Wilson.	Yadkin.	All other counties. ¹
1 Number of all farms in the county.....	3,169	1,110	2,020	5,630	4,971	4,439	2,646	55,129
2 Farms reporting land having drainage.....	85	321	249	1,689	370	1,271	164	651
3 Farms reporting land needing drainage.....	502	92	805	689	846	859	40	4,575
4 Farms in drainage and levee districts.....	.....	3	2	61	.....	25	.....	73
LAND AND FARM AREA.								
5 Approximate land area of the county..... acres..	272,000	209,280	103,920	365,440	470,400	238,720	207,360	6,299,520
6 All land in farms..... acres..	195,381	73,866	171,035	281,591	369,084	185,029	202,321	4,344,300
7 Improved land in farms..... acres..	81,031	35,422	84,138	140,009	109,895	98,641	78,920	1,574,082
8 Woodland in farms..... acres..	102,572	34,470	82,933	122,696	211,939	82,780	95,544	2,407,237
9 Other unimproved land in farms..... acres..	11,778	3,974	4,864	18,886	47,280	3,608	27,857	362,981
10 Farm land reported as provided with drainage..... acres..	1,075	8,794	1,980	35,765	2,142	28,025	2,390	5,559
11 Farm land reported as needing drainage..... acres..	28,305	3,415	25,942	19,168	22,974	18,944	792	148,724
12 Drainage only..... acres..	715	53	1,073	1,121	822	1,067	233	6,137
13 Drainage and clearing..... acres..	27,650	3,362	24,869	18,047	22,152	17,877	559	142,587

¹ No drainage in Orange and Person Counties.

DRAINAGE—NORTH CAROLINA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Beaufort.	Bladen.	Camden.	Carteret.	Cleveland.	Columbus.	
LAND AREA.									
1	Approximate land area of the state or county.....	acres..	31,193,600	537,600	624,640	140,800	366,720	317,440	597,120
2	All land in operating drainage enterprises.....	acres..	542,828	59,629	7,533	11,914	33,000	14,622	34,000
3	Improved land.....	acres..	201,928	24,803	6,731	2,979	150	10,967	5,300
4	Per cent of all improved land in farms.....		2.5	31.2	9.9	8.4	0.9	8.3	6.7
5	Timber and cut-over land.....	acres..	244,576	34,826	802	8,935	4,950		28,700
6	Other unimproved land.....	acres..	93,324				27,900	3,655	
7	Swampy or subject to overflow.....	acres..	77,494	3,000			32,850	2,193	
8	Suffering loss of crops from defective drainage.....	acres..	12,771					2,193	
9	Assessed acreage.....		552,428	59,629	7,533	11,914	33,000	14,622	34,000
10	Excess over all land in enterprises.....	acres..	9,600						
DRAINAGE WORKS.									
11	Open ditches:								
12	Completed.....	miles..	1,171.3	107.6	24.5	8.0	41.2	24.0	61.0
13	Additional under construction.....	miles..	367.8	8.0			233.8		
14	Maximum completed in any enterprise.....	miles..	110.0	42.5	10.0	8.0	41.2	24.0	42.0
15	Maximum width at bottom of ditch.....	feet..	70	46	28	30	8	35	14
16	Maximum of average depths of outlet ditches.....	feet..	14.0	10.0	8.0	7.0	8.0	10.0	11.0
17	Mean depth of branch ditches.....	feet..	6.7	8.0	4.1	7.0	6.0	8.0	8.2
18	Accessory levees and dikes:								
19	Completed.....	miles..	33.5		3.5				
20	Additional under construction.....	miles..							
21	Pumping plants:								
22	Engine capacity.....	horsepower.	1,000						
23	Pump capacity.....	gallons per minute.	1,000,000						
24	Area served by pumps.....	acres..	100,000						
25	Area drained by open ditches only.....	acres..	435,295	59,629		11,914	33,000	14,622	34,000
26	Length of these ditches.....	miles..	1,404.6	115.6		8.0	275.0	24.0	61.0
27	Average length per acre.....	feet..	17.0	10.2		3.5	44.0	8.7	9.5
28	Area having open ditches and levees.....	acres..	107,533		7,533				
29	Length of these ditches.....	miles..	134.5		24.5				
30	Average length per acre.....	feet..	6.6		17.2				
31	Length of these accessory levees.....	miles..	33.5		3.5				
DEVELOPMENT OF LAND.									
32	Improved land in operating enterprises, 1920.....	acres..	201,928	24,803	6,731	2,979	150	10,967	5,300
33	Improved land prior to drainage.....	acres..	84,714	5,819	838	2,383			3,000
34	Increase since drainage.....	acres..	120,214	18,984	5,893	596	150	10,967	2,300
35	Per cent of increase.....		141.9	326.2	703.2	25.0			76.7
36	Per cent increase is of all improved land in farms, 1920.....		1.5	23.9	8.6	1.7	0.9	8.3	2.9
37	Timber and cut-over land, 1920.....	acres..	244,576	34,826	802	8,935	4,950		28,700
38	Timber and cut-over land prior to drainage.....	acres..	311,626	52,010	6,695	9,531	4,950		31,000
39	Decrease since drainage.....	acres..	67,050	17,184	5,893	596			2,300
40	Per cent of decrease.....		21.5	33.0	88.0	6.3			7.4
41	Other unimproved land, 1920.....	acres..	93,324				27,900	3,655	
42	Other unimproved land prior to drainage.....	acres..	146,488	1,800			28,050	14,622	
43	Decrease since drainage.....	acres..	53,164	1,800			150	10,967	
44	Per cent of decrease.....		36.3	100.0			0.5	75.0	
45	Swampy or subject to overflow, 1920.....	acres..	77,494	3,000			32,850	2,193	
46	Swampy or subject to overflow prior to drainage.....	acres..	311,110	33,000	5,700	5,957	33,000	14,622	28,000
47	Decrease since drainage.....	acres..	233,616	30,000	5,700	5,957	150	12,429	28,000
48	Per cent of decrease.....		75.1	90.9	100.0	100.0	0.5	85.0	100.0
CAPITAL INVESTED AND COST PER ACRE.									
49	Total capital invested in and required for completion of operating enterprises.....	dollars..	4,526,018	333,250	61,000	30,000	395,000	75,000	232,000
50	Capital invested in these enterprises to Dec. 31, 1919.....	dollars..	3,623,518	304,250	61,000	30,000	65,000	75,000	232,000
51	Additional capital required to complete these enterprises.....	dollars..	902,500	29,000			330,000		
52	Average cost per acre when completed.....	dollars..	8.34	5.59	8.10	2.52	11.97	5.13	6.82
53	Enterprises constructing open ditches only.....	dollars..	3,729,644	333,250		30,000	395,000	75,000	232,000
54	Average cost per acre when completed.....	dollars..	8.57	5.59		2.52	11.97	5.13	6.82
55	Enterprises constructing open ditches and levees.....	dollars..	796,374		61,000				
56	Average cost per acre when completed.....	dollars..	7.41		8.10				
CROPS.									
57	Improved land in enterprises reporting—								
58	Corn as principal crop on drained land.....	acres..	183,658	21,803	6,731	2,979	150	10,967	5,300
59	Cotton as principal crop on drained land.....	acres..	19,678	3,000					
60	Other crops as principal ones on drained land.....	acres..	11,592						

¹ When works under construction have been completed.² Includes 242 acres not reporting principal crop.

DRAINAGE—NORTH CAROLINA.

11

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Craven.	Cumber- land.	Currituck.	Edge- combe.	Harnett.	Hyde.	Iredell.	Lenoir.
LAND AREA.									
1	Approximate land area of the county.....acres	422,400	428,800	186,880	325,760	376,320	394,880	376,320	249,600
2	All land in operating drainage enterprises.....acres	7,800	23,000	25,915	4,857	6,780	128,529	8,679	4,833
3	Improved land.....acres	2,190	13,800	8,579	4,857	5,048	33,728	7,509	2,376
4	Per cent of all improved land in farms.....	3.7	15.0	17.0	3.5	5.6	91.0	4.7	2.6
5	Timber and cut-over land.....acres	5,610	9,200	17,336			42,671	591	2,457
6	Other unimproved land.....acres					1,682	52,130	579	
7	Swampy or subject to overflow.....acres	380			251		28,636	1,874	
8	Suffering loss of crops from defective drainage.....acres	19			251			1,831	
9	Assessed acreage.....acres	7,800	23,000	25,915	4,857	6,780	131,329	8,679	4,833
10	Excess over all land in enterprises.....acres						2,800		
DRAINAGE WORKS.									
11	Open ditches:								
12	Completed.....miles	18.5	37.0	30.0	14.0	15.0	125.6	90.0	11.7
13	Additional under construction.....miles						95.3	4.2	
14	Maximum completed in any enterprise.....miles	10.5	37.0	22.0	6.0	15.0	110.0	15.5	8.0
15	Maximum width at bottom of ditch.....feet	30	16	30	20	14	70	35	30
16	Maximum of average depths of outlet ditches.....feet	8.0	6.0	7.0	12.0	10.0	10.0	9.0	8.0
17	Mean depth of branch ditches.....feet	5.9	6.0	5.9		4.0	7.7	7.2	5.0
18	Accessory levees and dikes:								
19	Completed.....miles						30.0		
20	Additional under construction.....miles								
21	Pumping plants:								
22	Engine capacity.....horsepower						1,000		
23	Pump capacity.....gallons per minute						1,000,000		
24	Area served by pumps.....acres						100,000		
25	Area drained by open ditches only.....acres	7,800	23,000	25,915	4,857	6,780	28,529	8,679	4,833
26	Length of these ditches.....miles	18.5	37.0	30.0	14.0	15.0	110.9	94.2	11.7
27	Average length per acre.....feet	12.5	8.5	6.1	15.2	11.8	20.5	57.3	12.8
28	Area having open ditches and levees.....acres						100,000		
29	Length of these ditches.....miles						110.0		
30	Average length per acre.....feet						5.8		
31	Length of these accessory levees.....miles						30.0		
DEVELOPMENT OF LAND.									
32	Improved land in operating enterprises, 1920.....acres	2,190	13,800	8,579	4,857	5,048	33,728	7,509	2,376
33	Improved land prior to drainage.....acres	1,600	9,200	7,283	1,525	4,038	25,185	2,895	1,042
34	Increase since drainage.....acres	590	4,600	1,296	3,332	1,010	8,543	4,614	734
35	Per cent of increase.....	36.9	50.0	17.8	218.5	25.0	33.9	159.4	44.7
36	Per cent increase is of all improved land in farms, 1920.....	1.0	5.0	2.6	2.4	1.1	23.1	2.9	0.8
37	Timber and cut-over land, 1920.....acres	5,610	9,200	17,336			42,671	591	2,457
38	Timber and cut-over land prior to drainage.....acres	6,200	13,800	18,632			51,214	1,660	3,191
39	Decrease since drainage.....acres	590	4,600	1,296			8,543	1,069	734
40	Per cent of decrease.....	9.5	33.3	7.0			16.7	64.4	23.0
41	Other unimproved land, 1920.....acres					1,682	52,130	579	
42	Other unimproved land prior to drainage.....acres				3,332	2,092	52,130	4,124	
43	Decrease since drainage.....acres				3,332	1,010		3,545	
44	Per cent of decrease.....				100.0	37.5		86.0	
45	Swampy or subject to overflow, 1920.....acres	380			251		28,636	1,874	
46	Swampy or subject to overflow prior to drainage.....acres	7,800			4,332	3,865	75,622	3,935	4,000
47	Decrease since drainage.....acres	7,420			4,081	3,365	46,986	2,061	4,000
48	Per cent of decrease.....	95.1			94.2	100.0	62.1	52.4	100.0
CAPITAL INVESTED AND COST PER ACRE.									
49	Total capital invested in and required for completion of operating enterprises.....dollars	89,000	76,500	73,000	30,000	30,000	1,215,272	197,225	32,500
50	Capital invested in these enterprises to Dec. 31, 1919.....dollars	89,000	76,500	73,000	30,000	30,000	800,272	183,725	32,500
51	Additional capital required to complete these enterprises.....dollars						415,000	13,500	
52	Average cost per acre when completed.....dollars	11.41	3.33	2.82	6.18	4.46	22.72	22.72	6.72
53	Enterprises constructing open ditches only.....dollars	89,000	76,500	73,000	30,000	30,000	479,898	197,225	32,500
54	Average cost per acre when completed.....dollars	11.41	3.33	2.82	6.18	4.46	16.82	22.72	6.72
55	Enterprises constructing open ditches and levees.....dollars						735,374		
56	Average cost per acre when completed.....dollars						7.35		
CROPS.									
57	Improved land in enterprises reporting—								
58	Corn as principal crop on drained land.....acres	2,190	13,800	8,579	4,157		33,728	7,509	2,376
59	Cotton as principal crop on drained land.....acres				700	5,048			
60	Other crops as principal ones on drained land.....acres								

¹ When works under construction have been completed.

DRAINAGE—NORTH CAROLINA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Mecklen- burg.	Pamlico.	Perqui- mans.	Pitt.	Robeson.	Rowan.	Washing- ton.	Other counties, ¹
LAND AREA.									
1	Approximate land area of the county.....acres..	382,080	224,000	161,280	401,280	633,600	312,960	209,280	23,523,840
2	All land in operating drainage enterprises.....acres..	17,224	19,875	8,300	0,200	32,600	7,027	38,444	42,117
3	Improved land.....acres..	14,358	867	8,300	1,760	9,780	5,151	5,617	30,078
4	Per cent of all improved land in farms.....	9.5	2.5	17.1	1.2	4.7	3.6	15.9	2.3
5	Timber and cut-over land.....acres..	484	19,008		4,440	22,820	960	32,827	7,959
6	Other unimproved land.....acres..	2,382					916		4,080
7	Swampy or subject to overflow.....acres..	1,133			250		1,200	1,251	4,476
8	Suffering loss of crops from defective drainage.....acres..	1,247		1,500	171		1,174	261	4,134
9	Assessed acreage.....acres..	17,224	19,875	8,300	6,200	32,600	7,027	45,244	42,117
10	Excess over all land in enterprises.....acres..							6,800	
DRAINAGE WORKS.									
11	Open ditches:								
12	Completed.....miles..	50.0	25.0	14.0	20.0	55.0	63.0	88.6	247.6
13	Additional under construction.....miles..							26.4	1.1
14	Maximum completed in any enterprise.....miles..	14.0	20.0	10.0	11.5	55.0	12.0	58.0	14.0
15	Maximum width at bottom of ditch.....feet..	36	20	30	30	22	50	46	40
16	Maximum of average depths of outlet ditches.....feet..	9.0	9.0	11.0	8.0	8.0	11.0	8.5	14.0
17	Mean depth of branch ditches.....feet..	8.0	6.8		7.0	6.0	6.5	9.1	5.5
18	Accessory levees and dikes:								
19	Completed.....miles..								
20	Additional under construction.....miles..								
21	Pumping plants:								
22	Engine capacity.....horsepower..								
23	Pump capacity.....gallons per minute..								
24	Area served by pumps.....acres..								
25	Area drained by open ditches only.....acres..	17,224	19,875	8,300	6,200	32,600	7,027	38,444	42,117
26	Length of these ditches.....miles..	50.0	25.0	14.0	20.0	55.0	63.0	114.0	248.7
27	Average length per acre.....feet..	15.3	6.6	8.9	17.0	8.9	47.3	15.7	31.2
28	Area having open ditches and levees.....acres..								
29	Length of these ditches.....miles..								
30	Average length per acre.....feet..								
31	Length of these accessory levees.....miles..								
DEVELOPMENT OF LAND.									
32	Improved land in operating enterprises, 1920.....acres..	14,358	867	8,300	1,760	9,780	5,151	5,617	30,078
33	Improved land prior to drainage.....acres..	1,470		3,530	150	6,520	681	1,136	5,819
34	Increase since drainage.....acres..	12,888	867	4,770	1,610	3,260	4,470	4,481	24,259
35	Per cent of increase.....	876.7		135.1		50.0	656.4	394.5	416.9
36	Per cent increase is of all improved land in farms, 1920.....	8.5	2.5	9.8	1.1	1.6	3.1	12.7	1.9
37	Timber and cut-over land, 1920.....acres..	484	19,008		4,440	22,820	960	32,827	7,959
38	Timber and cut-over land prior to drainage.....acres..	3,043	19,875	4,770	0,050	20,080	1,593	37,308	14,024
39	Decrease since drainage.....acres..	2,559	867	4,770	1,610	3,260	683	4,481	6,065
40	Per cent of decrease.....	84.1	4.4	100.0	26.6	12.5	39.7	12.0	43.2
41	Other unimproved land, 1920.....acres..	2,382							4,080
42	Other unimproved land prior to drainage.....acres..	12,711					916		22,274
43	Decrease since drainage.....acres..	10,329					4,753		18,104
44	Per cent of decrease.....	81.3					80.7		81.7
45	Swampy or subject to overflow, 1920.....acres..	1,133			250		1,200	1,251	4,476
46	Swampy or subject to overflow prior to drainage.....acres..	16,308	16,000		5,200		3,210	24,151	26,908
47	Decrease since drainage.....acres..	15,175	16,000		4,950		2,010	22,900	22,432
48	Per cent of decrease.....	93.1	100.0		95.2		62.6	94.8	83.4
CAPITAL INVESTED AND COST PER ACRE.									
49	Total capital invested in and required for completion of operating enter- prises.....dollars..	115,101	96,000	45,625	77,600	165,000	129,026	440,352	587,567
50	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	115,101	96,000	45,625	77,600	165,000	129,026	440,352	578,567
51	Additional capital required to complete these enterprises.....dollars..							106,000	9,000
52	Average cost per acre when completed.....dollars..	6.68	4.83	5.50	12.52	5.06	18.36	11.45	13.95
53	Enterprises constructing open ditches only.....dollars..	115,101	96,000	45,625	77,600	165,000	129,026	440,352	587,567
54	Average cost per acre when completed.....dollars..	6.68	4.83	5.50	12.52	5.06	18.36	11.45	13.95
55	Enterprises constructing open ditches and levees.....dollars..								
56	Average cost per acre when completed.....dollars..								
CROPS.									
57	Improved land in enterprises reporting—								
58	Corn as principal crop on drained land.....acres..	14,358	867	8,300	960		5,151	5,617	28,136
59	Cotton as principal crop on drained land.....acres..				800	9,780			850
60	Other crops as principal ones on drained land.....acres..								41,592

¹ Includes only Alexander, Burke, Cabarrus, Caldwell, Catawba, Chowan, Davidson, Forsyth, Gaston, Greene, Jones, Lincoln, McDowell, New Hanover, Pender, Tyrrell, Wayne, and Wilson Counties.

² When works under construction have been completed.

³ Per cent not shown when more than 1,000.

⁴ Includes 242 acres not reporting principal crop.

DRAINAGE : NORTH DAKOTA

STATISTICS FOR THE STATE AND ITS COUNTIES

Prepared under the supervision of WILLIAM LANE AUSTIN, Chief Statistician for Agriculture, by ROGER D. MARSDEN, Special Agent in Charge of Drainage

CONTENTS.

	Page.		Page.
INTRODUCTION.....	1	DRAINAGE ENTERPRISES—Continued.	
MAP SHOWING OPERATING DRAINAGE ENTERPRISES.....	2	Size of enterprises.....	4
DRAINAGE ON FARMS.....	3	Character of enterprises.....	5
Explanation of terms.....	3	Drainage works.....	5
Farms and farm land.....	3	Maintenance of works.....	6
DRAINAGE ENTERPRISES.....	3	Date of organization.....	6
Explanation of terms.....	3	Crops.....	6
Operating and nonoperating enterprises.....	4	COUNTY TABLES:	
Location of enterprises.....	4	I.—Drainage on farms: 1920.....	7
Condition of land in enterprises.....	4	II.—Operating drainage enterprises: 1920.....	8

INTRODUCTION.

This bulletin presents the statistics of drainage for North Dakota collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include considerable areas of unimproved land not yet

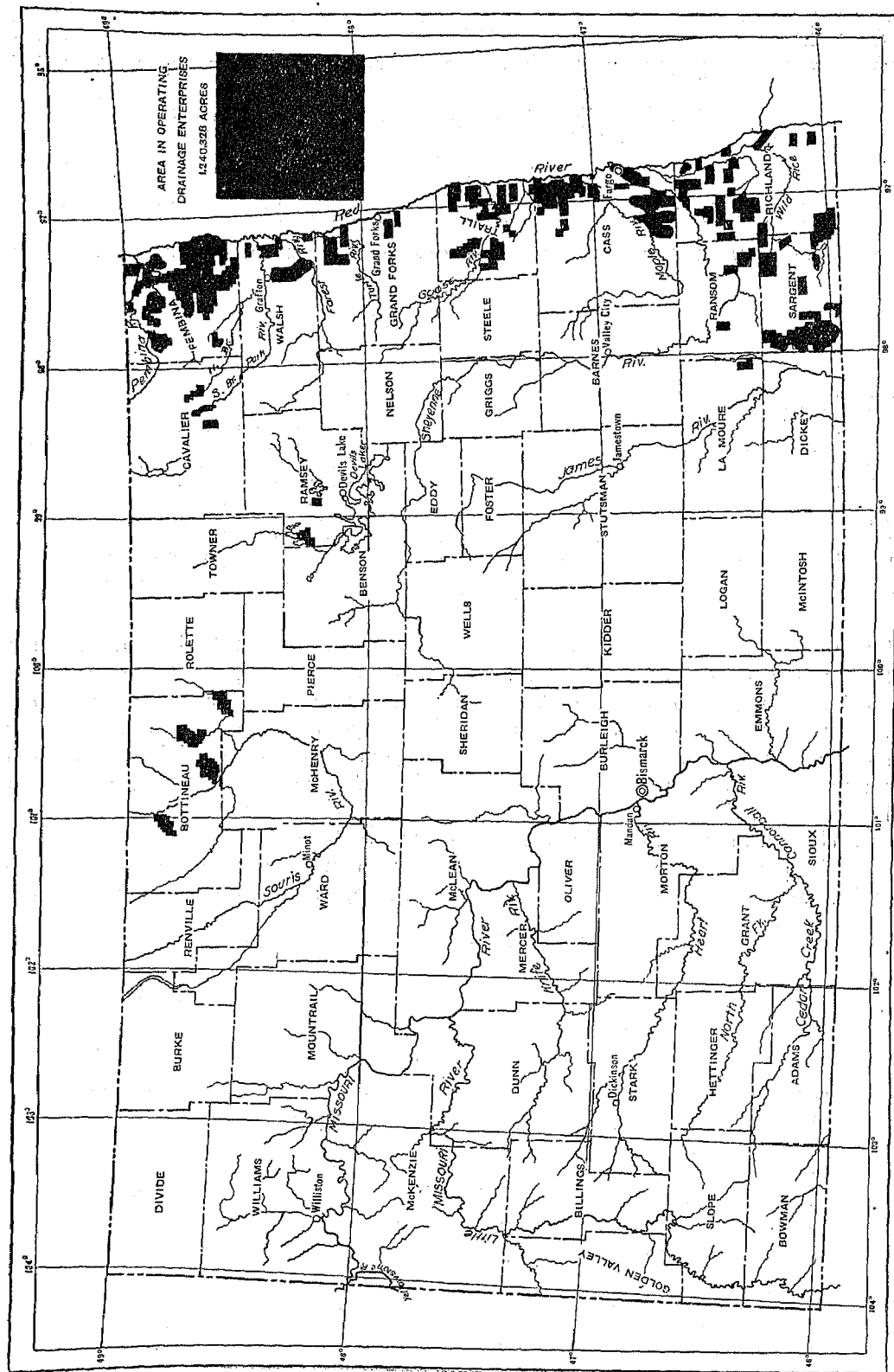
in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner constructs on his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are shown separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
DRAINAGE ON FARMS.		
Number of all farms in the state.....	77, 690	100. 0
Farms reporting land having drainage.....	682	0. 9
Farms reporting land needing drainage.....	2, 669	3. 4
All land in farms..... acres..	36, 214, 751	100. 0
Improved land in farms..... acres..	24, 563, 178	67. 8
Farm land reported as provided with drainage..... acres..	89, 054	0. 2
Farm land reported as needing drainage..... acres..	211, 305	0. 6
DRAINAGE ENTERPRISES.		
Approximate land area of the state..... acres..	44, 917, 120	100. 0
All land in operating drainage enterprises..... acres..	1, 240, 328	2. 8
Improved land..... acres..	1, 026, 574	2. 3
Unimproved land ¹ acres..	213, 754	0. 5
Capital invested in and required for completion of operating enterprises...	\$2, 261, 449	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	\$2, 208, 049	97. 6
Additional capital required to complete these enterprises.....	\$53, 400	2. 4

¹ No timber or cut-over land reported.

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



DRAINAGE ON FARMS.

Explanation of terms.—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which are substantially as follows:

Drainage of agricultural land was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purpose of improving the condition of the soil and crops.

The area provided with drainage, in farms, is the acreage actually benefited or made of more value for agricultural purposes by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land not now suitable for crops which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators have answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual?" Levee districts, however, generally are not included in the enterprises for which data are given in this bulletin (see definition of drainage enterprises, below).

Farms and farm land.—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for growing crops by reason of the drainage. This is to be distinguished from the area merely provided with outlet facilities by organized drainage enterprises. Drainage on farms represents in most cases the result of work done by the farm owner, either independently or supplemental to the work done by a drainage enterprise, but the acreage would include also any farm land receiving similar benefits directly from the works of an enterprise.

DRAINAGE ENTERPRISES.

Explanation of terms.—The more important terms used in connection with the census of drainage enterprises were defined as follows:

Drainage enterprises comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swamp or overflowed land for sale, other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditches or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise, though the capacities of drainage pumping plants are given only in the counties in which the plants are located.

Operating enterprises, as designated in this bulletin, are those that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

Land in drainage enterprises comprises the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises, deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (a) improved land; (b) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (c) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be considerably greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprises.

Timber and cut-over land includes farm woodland of natural or

planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, land subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering loss of crops is intended to include only land devoted to planted crops which suffer damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A pumping district is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

DRAINAGE—NORTH DAKOTA.

Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of reclamation some years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertaking, and let contracts for the construction work, and also districts that had just been established by the drain commissioners and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. ¹			
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.	
			Amount.	Per cent of total.		
All organized enterprises.....	1,248,328	100.0	\$2,208,049	100.0	\$77,723	
Operating enterprises.....	1,240,328	99.4	2,208,049	100.0	53,400	
With works completed.....	1,100,044	88.1	1,863,788	84.4		
With works under construction.	140,284	11.2	344,261	15.6	53,400	
Nonoperating enterprises.....	8,000	0.6			24,323	

¹ The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—All but a small part of the area in drainage enterprises in North Dakota is in the extreme eastern part of the state, in the broad belt of comparatively level land which borders Red River. A small area in La Moure County is drained through James River to the Missouri, and the enterprises in Bottineau County are drained through Souris River.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.			
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.	
			Amount.	Per cent of total.		
All organized enterprises...	1,248,328	100.0	\$2,208,049	100.0	\$77,723	
Operating enterprises.....	1,240,328	99.4	2,208,049	100.0	53,400	
Missouri River.....	3,300	0.3	22,500	1.0		
Red River.....	1,187,233	95.1	2,014,453	91.2	53,400	
Souris River.....	49,795	4.0	171,096	7.8		
Nonoperating enterprises.....	8,000	0.6			24,323	
Red River.....	8,000	0.6			24,323	

Condition of land in enterprises.—The purpose of the drainage enterprises in this state has been the reclamation and improvement of swampy land or

land subject to overflow. None of the enterprises is for the drainage of irrigated land. The natural channels of the streams tributary to Red River where they cross the level bottom land are not adequate to carry the run-off from storms and from melting snow on the hills to the west. Many of the well-defined channels of small and moderate size practically disappear at short distances below the foot of the hills, so the waters are spread over considerable areas until artificial channels are provided. The drainage of this valley as a whole is rendered specially difficult by the northward course of Red River, which may be ice-bound north of the Canadian boundary while higher temperatures in Minnesota and the Dakotas are melting the snow and causing that stream to overflow.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflows for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Nonoperating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	1,240,328	100.0	1,100,044	140,284	8,000
Improved land.....	1,026,574	82.8	920,304	106,270	5,334
Unimproved land.....	213,754	17.2	179,740	34,014	2,666
Swampy or subject to overflow.	12,332	1.0	12,332		2,000
Suffering a loss of crops.....	4,819	0.4	4,819		

¹ No timber or cut-over land reported.

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided and the part in each county be considered a separate enterprise. In this way, 137 operating drainage enterprises are counted in North Dakota, with an average area of 9,053 acres. There is no overlapping of the enterprises in this state.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

AREA ASSESSED.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	1,240,328	1,240,328	100.0
500 to 999 acres.....	640	640	0.1
1,000 to 4,999 acres.....	148,680	148,680	12.0
5,000 to 9,999 acres.....	358,390	358,390	28.9
10,000 to 49,999 acres.....	501,377	501,377	40.4
50,000 to 99,999 acres.....	231,241	231,241	18.6

Character of enterprises.—All the drainage enterprises in North Dakota are county drains under the control of the county board of drain commissioners. This board of three freeholders is appointed by the board of county commissioners upon their own volition or upon petition from interested landowners.

The board of drain commissioners may establish drains for wet land whenever such drains will be conducive to public health, convenience, and welfare. If the chief object sought is to drain land to be used for agricultural purposes, a petition for the drain must be signed by six or more freeholders whose property will be affected. Plans, specifications, and estimates are prepared by a surveyor employed by the drain commissioners, who hold a public hearing upon the surveyor's report. The drain is established if sufficient cause for the petition is shown and if the cost of the proposed drain will not exceed the benefits to be derived, provided two-thirds of the landowners who would be subject to assessment do not petition against establishment. Appeal from the decision establishing a drain may be taken to the district court for trial without jury. The cost of the enterprise is assessed against the tracts of land in proportion to the benefits they will receive. Counties, cities, towns, and railroads are assessed if they will be benefited.

Damages for rights of way are determined by jury in the district court, or by the court or a referee if jury trial is waived. Assessments of benefits are made by the board of drain commissioners and reviewed by them at a public hearing. An appeal from these assessments, or for review of the location and design of any drain, may be made to the state engineer by two-thirds of the landowners affected by the drain. Contracts for construction are let by the drain commissioners. Bonds to finance the enterprise may be issued by the board of county commissioners, to run not more than 15 years and to be paid only from the assessments levied for the drain. When a drain is to be located in more than one county, the petition is presented to the board of drain commissioners in each county affected, and all those boards act jointly.

The present county drainage law of North Dakota was enacted March 8, 1895 (ch. 51), but has been amended many times. The principal amendments relate to the number of signatures on the petition (1903), to appeals from decisions of the drain commissioners (1911 and 1915), and to the time of payment of bonds (1901 and 1907). The first general drainage law of the state was enacted March 18, 1893 (ch. 55). It provided for the appointment of a county board of drain commissioners and for a method of establishing county drains generally similar to that provided in the law of 1895, which repealed the earlier statute. Only one enterprise, of 3,520 acres, was reported as organized under the law of 1893.

Township drains may be established by the board of supervisors of any township under a law of March 12, 1915 (ch. 124), as amended March 3, 1919 (ch. 114). These are under the control of the township supervisors. The cost is paid from the township funds if the cost does not exceed \$3,000 and if the enterprise is approved by a majority vote of the people of the township; otherwise the cost is assessed in proportion to benefits. No enterprises were reported as organized under this law.

An act of March 13, 1919 (ch. 115), created a flood-control commission, consisting of the dean of the state agricultural college, the dean of the state school of mines, the state engineer, and two citizens appointed by the governor, to make surveys and plans for controlling floods.

Laws authorizing the establishment of public drains by boards of county commissioners and by boards of township supervisors, upon petition of one or more owners of land to be affected, were enacted by the legislature of Dakota territory in 1883. Viewers were appointed to locate the drains and to assess damages and benefits, the costs being assessed against the lands in proportion to the benefits.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 708.3 miles of open ditches, 9.3 miles of tile drains, and 2.1 miles of accessory levees; the additional works under construction were 4.0 miles of open ditches. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the drainage enterprises, nor the works of flood protection or levee districts that had not undertaken the construction of ditches or tile drains. There are no pumping districts in the state.

TABLE 6.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	1,240,328	100.0	\$2,208,019	100.0	\$53,400
Open ditches only.....	1,217,028	98.1	2,146,788	97.2	53,400
Open ditches and levees.....	9,600	0.8	12,368	0.6	.....
Tile drains only.....	10,820	0.9	42,908	1.9	.....
Open ditches and tile drains.....	2,880	0.2	6,015	0.3	.....

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 14 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

DRAINAGE—NORTH DAKOTA.

In County Table II, line 15 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet were omitted; to include this group, computed as 3 feet, would not change the mean depth for the state, 3.7 feet.

TABLE 7.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	1,240,328	100.0
Less than 3 feet.....	15,600	1.2
3.0 to 3.9 feet.....	96,200	7.8
4.0 to 4.9 feet.....	227,124	18.3
Not reporting branches.....	901,404	72.7

Maintenance of works.—The drainage law of 1895 provided that all drains constructed under that act should be kept in good repair by the board of county commissioners, and the existing statutes have made that provision applicable to the improvements established under any drainage law of the state. In the case of a drain that is situated in more than one county, the board of county commissioners of each county affected is required to keep in good condition the portion of the drain that is situated in that county. However, systematic maintenance was reported for enterprises embracing a total of only 82,080 acres, representing an investment of \$82,459, the work being done by contract.

Date of organization.—The progress in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the drain commissioners, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, including extensions made after the original plan of reclamation was completed.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	1,240,328	100.0	1,240,328	100.0
1890 to 1899.....	87,340	7.0	87,340	7.0
1900 to 1904.....	176,055	14.2	176,055	14.2
1905 to 1909.....	611,659	49.3	611,659	49.3
1910 to 1914.....	61,380	5.0	61,380	5.0
1915 to 1919.....	303,894	24.5	303,894	24.5

TABLE 9.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL INVESTED.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$2,208,049	100.0	\$53,400
1890 to 1899.....	154,031	7.0	.....
1900 to 1904.....	183,657	8.3	.....
1905 to 1909.....	905,459	43.7	.....
1910 to 1914.....	70,940	3.2	.....
1915 to 1919.....	833,932	37.8	53,400

TABLE 10.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total. ¹	Miles.	Per cent of total. ¹
All drains and levees..	712.3	100.0	9.3	100.0	2.1	100.0
1890 to 1899.....	63.3	8.9	.....	.....	0.1	.....
1900 to 1904.....	90.5	12.7	.....	.....	2.0	.....
1905 to 1909.....	334.8	47.0	0.3	.....	.....	.....
1910 to 1914.....	32.7	4.6	.....	.....	.....	.....
1915 to 1919.....	191.0	26.8	9.0	.....	.....	.....

¹ Per cent not shown when base is less than 100.

Crops.—The principal crop grown upon the drained land was reported as wheat for most of the drainage enterprises, though hay was so reported for a small part of them. Statistics were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. Information was not obtained at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE—NORTH DAKOTA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Bottineau.	Cass.	Cavalier.	Grand Forks.	La Moure.
LAND AREA.							
1	Approximate land area of the state or county.....	acres.. 44,917,120	1,075,840	1,128,320	959,160	917,120	734,080
2	All land in operating drainage enterprises.....	acres.. 1,240,328	49,795	201,580	12,700	47,000	3,300
3	Improved land.....	acres.. 1,026,574	32,000	155,135	4,019	40,586	2,640
4	Per cent of all improved land in farms.....	4.2	4.0	16.4	0.5	5.6	0.5
5	Unimproved land ¹	acres.. 213,754	17,795	46,445	8,681	6,414	600
6	Swampy or subject to overflow, in enterprises.....	acres.. 12,332		960			
7	Suffering loss of crops from defective drainage.....	acres.. 4,819			12,700	47,000	3,300
8	Assessed acreage.....	1,240,328	49,795	201,580			
9	Excess over all land in operating enterprises.....	acres..					
DRAINAGE WORKS.							
10	Open ditches:						
11	Completed.....	miles.. 708.3	44.0	177.3	12.0	25.8	
12	Additional under construction.....	miles.. 4.0		1.5			
13	Maximum completed in any enterprise.....	miles.. 45.1	20.0	15.0	5.0	10.2	
14	Maximum width at bottom of ditch ²	feet.. 80	80	20	6	12	
15	Maximum of average depths of outlet ditches ²	feet.. 14.0	6.0	14.0	5.0	6.0	
16	Mean depth of branch ditches ²	feet.. 3.7					
17	Tile drains:						
18	Completed.....	miles.. 9.3					4.5
19	Additional under construction.....	miles.. 4.5					4.5
20	Maximum completed in any enterprise.....	miles.. 22					22
21	Maximum size of tile ²	inches..					
22	Accessory levees and dikes:						
23	Completed.....	miles.. 2.1					
24	Additional under construction.....	miles..					
25	Area drained by open ditches only ²	acres.. 1,217,028	49,795	201,580	12,700	47,000	
26	Length of these ditches.....	miles.. 706.0	44.0	178.8	12.0	25.8	
27	Average length per acre.....	feet.. 3.1	4.7	4.7	5.0	2.9	
28	Area having both open ditches and levees ²	acres.. 9,600					
29	Length of these ditches.....	miles.. 4.0					
30	Average length per acre.....	feet.. 2.2					
31	Length of these accessory levees.....	miles.. 2.1					
32	Area drained by tile only ²	acres.. 10,820					3,300
33	Length of these tile.....	miles.. 9.0					4.5
34	Average length per acre.....	feet.. 4.4					7.2
35	Area drained by both ditches and tile ²	acres.. 2,880					
36	Length of these drains.....	miles.. 2.6					
37	Average length per acre.....	feet.. 4.8					
DEVELOPMENT OF LAND.							
38	Improved land in operating enterprises, 1920.....	acres.. 1,026,574	32,000	155,135	4,019	40,586	2,640
39	Improved land prior to drainage.....	acres.. 691,005	26,000	115,764	3,473	28,548	2,475
40	Increase since drainage.....	acres.. 335,569	6,000	39,371	546	12,038	165
41	Per cent of increase.....	48.6	23.1	34.0	15.7	42.2	6.7
42	Per cent increase is of all improved land in farms, 1920.....	2.4	0.8	4.2	0.1	1.7	()
43	Unimproved land, 1920.....	acres.. 213,754	17,795	46,445	8,681	6,414	600
44	Unimproved land prior to drainage.....	acres.. 549,323	29,795	85,816	9,227	18,452	825
45	Decrease since drainage.....	acres.. 335,569	6,000	39,371	546	12,038	165
46	Per cent of decrease.....	61.1	25.2	45.9	5.9	65.2	20.0
47	Swampy or subject to overflow, 1920.....	acres.. 12,332		960			
48	Swampy or subject to overflow prior to drainage.....	acres.. 619,159	26,659	120,086	9,653	21,060	1,650
49	Decrease since drainage.....	acres.. 606,827	26,659	119,126	9,653	21,060	1,650
50	Per cent of decrease.....	98.0	100.0	99.2	100.0	100.0	100.0
CAPITAL INVESTED AND COST PER ACRE.							
51	Total capital invested in and required for completion of operating enterprises.....	dollars.. 2,261,449	171,096	837,690	15,785	49,894	22,500
52	Capital invested in these enterprises to Dec. 31, 1919.....	dollars.. 2,208,049	171,096	806,690	15,785	49,894	22,500
53	Additional capital required to complete these enterprises.....	dollars.. 53,400		31,000			
54	Average cost per acre, when completed.....	dollars.. 1.82	3.44	4.16	1.24	1.06	6.82
55	Enterprises constructing open ditches only.....	dollars.. 2,200,158	171,096	837,690	15,785	49,894	
56	Average cost per acre, when completed.....	dollars.. 1.81	3.44	4.16	1.24	1.06	
57	Enterprises constructing open ditches and levees.....	dollars.. 12,368					
58	Average cost per acre, when completed.....	dollars.. 1.29					
59	Enterprises constructing tile drains only.....	dollars.. 42,908					
60	Average cost per acre, when completed.....	dollars.. 3.97					22,500
61	Enterprises constructing open ditches and tile drains.....	dollars.. 6,015					6.82
62	Average cost per acre, when completed.....	dollars.. 2.09					
CROPS.							
63	Improved land in enterprises reporting—						
64	Wheat as principal crop on drained land.....	acres.. 1,000,889	24,000	155,135		40,586	2,640
65	Hay and forage as principal crop on drained land.....	acres.. 26,185	8,000		4,019		

¹ No timber or cut-over land reported.² When works under construction have been completed.³ Less than one-tenth of 1 per cent.

DRAINAGE—NORTH DAKOTA.

9

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Pembina.	Ramsey.	Ransom.	Richland.	Sargent.	Traill.	Walsh.
LAND AREA.								
1	Approximate land area of the county	714,880	771,200	550,400	919,680	547,200	553,600	820,480
2	All land in operating drainage enterprises	280,800	12,715	23,640	204,063	205,655	145,460	53,620
3	Improved land	250,778	11,443	14,120	171,911	162,151	126,527	49,264
4	Per cent of all improved land in farms	45.3	1.8	3.5	23.3	37.6	27.1	7.6
5	Unimproved land	24,022	1,272	9,520	32,152	43,604	18,933	4,356
6	Swampy or subject to overflow, in enterprises	512			5,980		4,880	
7	Suffering loss of crops from defective drainage				4,179		640	
8	Assessed acreage	280,800	12,715	23,640	204,063	205,655	145,460	53,620
9	Excess over all land in operating enterprises							
DRAINAGE WORKS.								
10	Open ditches:							
11	Completed	145.8	4.0	14.5	102.2	76.6	87.1	19.0
12	Additional under construction					2.5		
13	Maximum completed in any enterprise	24.0	2.5	6.5	12.5	45.1	8.5	7.0
14	Maximum width at bottom of ditch	24	9	12	17	16	10	14
15	Maximum of average depths of outlet ditches	7.0	4.0	5.0	10.0	8.0	8.0	4.7
16	Mean depth of branch ditches	3.6		3.0	3.5	4.0		3.0
17	Tile drains:							
18	Completed					4.8		
19	Additional under construction					4.5		
20	Maximum completed in any enterprise					18		
21	Maximum size of tile							
22	Accessory levees and dikes:							
23	Completed	2.1						
24	Additional under construction							
25	Area drained by open ditches only	271,200	12,715	23,640	204,063	195,255	145,460	53,620
26	Length of these ditches	141.8	4.0	14.5	102.2	76.6	87.1	19.0
27	Average length per acre	2.8	1.7	3.2	2.6	2.1	3.2	1.9
28	Area having both open ditches and levees	9,600						
29	Length of these ditches	4.0						
30	Average length per acre	2.2						
31	Length of these accessory levees	2.1						
32	Area drained by tile only					7,520		
33	Length of these tile					4.5		
34	Average length per acre					3.2		
35	Area drained by both ditches and tile					2,880		
36	Length of these drains					2.6		
37	Average length per acre					4.8		
DEVELOPMENT OF LAND.								
38	Improved land in operating enterprises, 1920	256,778	11,443	14,120	171,911	162,151	126,527	49,264
39	Improved land prior to drainage	179,720	3,075	9,550	124,962	57,412	100,406	39,620
40	Increase since drainage	77,058	8,368	4,570	46,949	104,739	26,121	9,644
41	Per cent of increase	42.9	272.1	47.9	37.6	182.4	26.0	24.3
42	Per cent increase is of all improved land in farms, 1920	13.6	1.3	1.1	6.4	24.3	5.0	1.5
43	Unimproved land, 1920	24,022	1,272	9,520	32,152	43,604	18,933	4,356
44	Unimproved land prior to drainage	101,080	9,640	14,090	79,101	148,243	45,054	14,000
45	Decrease since drainage	77,058	8,368	4,570	46,949	104,739	26,121	9,644
46	Per cent of decrease	76.2	88.8	32.4	59.4	70.7	58.0	68.9
47	Swampy or subject to overflow, 1920	512			5,980		4,880	
48	Swampy or subject to overflow prior to drainage	95,031	9,640	20,000	126,308	102,006	63,326	22,240
49	Decrease since drainage	94,519	9,640	20,000	120,328	102,006	58,446	22,240
50	Per cent of decrease	99.5	100.0	100.0	95.3	100.0	92.3	100.0
CAPITAL INVESTED AND COST PER ACRE.								
51	Total capital invested in and required for completion of operating enterprises	297,282	6,553	45,930	265,008	285,839	224,671	38,601
52	Capital invested in these enterprises to Dec. 31, 1919	297,282	6,553	45,930	265,008	283,439	224,671	38,601
53	Additional capital required to complete these enterprises					22,400		
54	Average cost per acre, when completed	1.06	0.62	1.94	1.30	1.39	1.54	0.72
55	Enterprises constructing open ditches only	284,914	6,553	45,930	265,008	259,416	224,671	38,601
56	Average cost per acre, when completed	1.05	0.62	1.94	1.30	1.33	1.54	0.72
57	Enterprises constructing open ditches and levees	12,368						
58	Average cost per acre, when completed	1.29						
59	Enterprises constructing tile drains only					20,408		
60	Average cost per acre, when completed					2.71		
61	Enterprises constructing open ditches and tile drains					6,015		
62	Average cost per acre, when completed					2.09		
CROPS.								
63	Improved land in enterprises reporting—							
64	Wheat as principal crop on drained land	256,778	11,443	6,900	166,911	160,205	120,527	49,264
65	Hay and forage as principal crop on drained land			7,220	6,000	1,946		

¹ No timber or cut-over land reported.² When works under construction have been completed.

FOURTEENTH CENSUS OF THE UNITED STATES: 1920

DEPARTMENT
OF COMMERCE

BULLETIN

BUREAU OF
THE CENSUS

DRAINAGE : OHIO

STATISTICS FOR THE STATE AND ITS COUNTIES

Prepared under the supervision of WILLIAM LANE AUSTIN, Chief Statistician for Agriculture, by ROGER D. MARSDEN, Special Agent in Charge of Drainage

CONTENTS.

	Page.		Page
INTRODUCTION.....	1	DRAINAGE ENTERPRISES—Continued.	
MAP SHOWING OPERATING DRAINAGE ENTERPRISES.....	2	Size of enterprises.....	4
DRAINAGE ON FARMS.....	3	Character of enterprises.....	5
Explanation of terms.....	3	Drainage works.....	6
Farms and farm land.....	3	Maintenance of works.....	7
DRAINAGE ENTERPRISES.....	3	Date of organization.....	7
Explanation of terms.....	3	Crops.....	8
Operating and nonoperating enterprises.....	4	COUNTY TABLES:	
Location of enterprises.....	4	I.—Drainage on farms: 1920.....	8
Condition of land in enterprises.....	4	II.—Operating drainage enterprises: 1920.....	11

INTRODUCTION.

This bulletin presents the statistics of drainage for Ohio collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises might include areas of unimproved land not yet in farms. The statistics

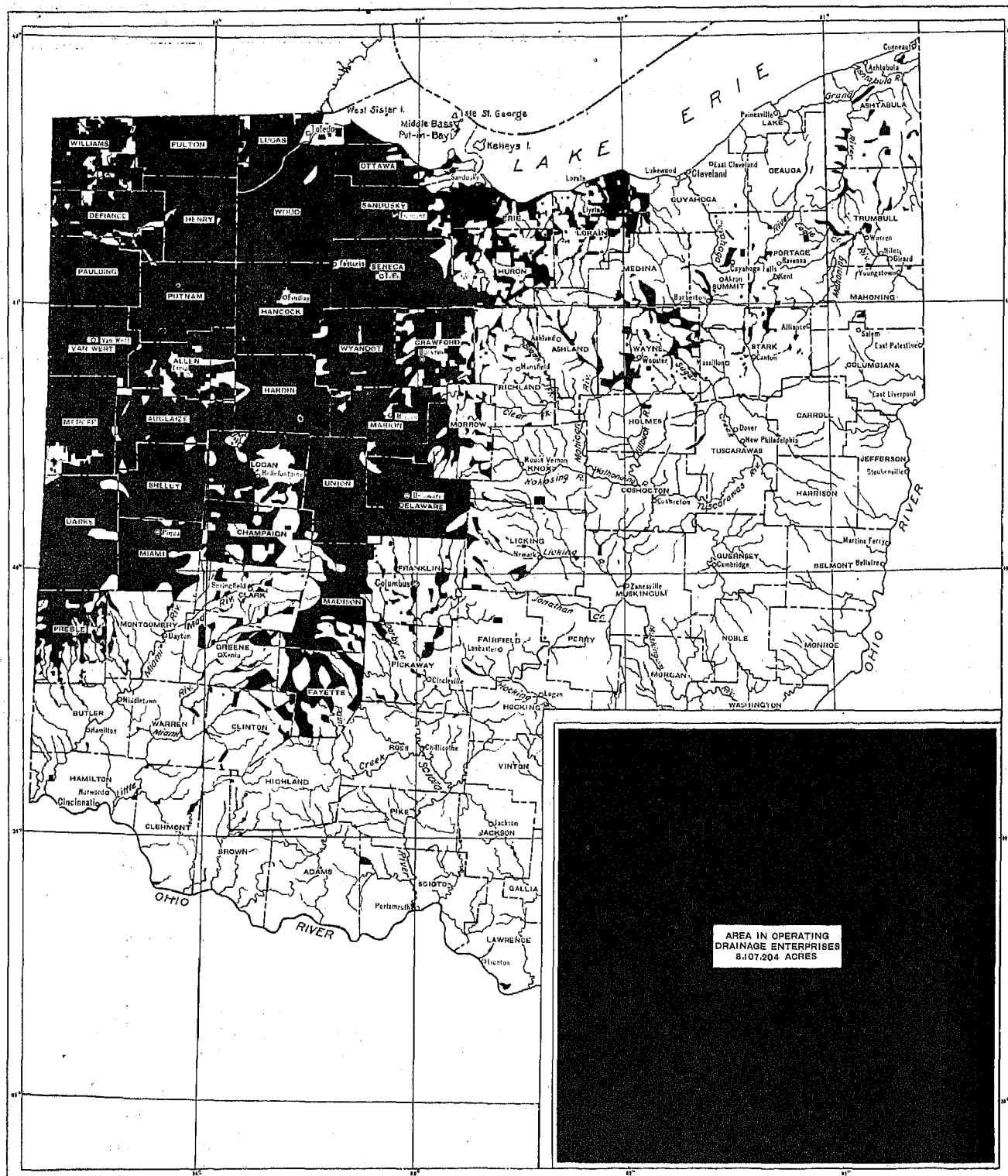
for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
DRAINAGE ON FARMS.		
Number of all farms in the state.....	256, 695	100.0
Farms reporting land having drainage.....	130, 117	50.7
Farms reporting land needing drainage.....	85, 326	33.2
All land in farms..... acres.	23, 515, 888	100.0
Improved land in farms..... acres.	18, 542, 353	78.9
Farm land reported as provided with drainage..... acres.	7, 365, 532	31.3
Farm land reported as needing drainage..... acres.	2, 014, 889	8.6
DRAINAGE ENTERPRISES.		
Approximate land area of the state..... acres.	26, 073, 600	100.0
All land in operating drainage enterprises..... acres.	8, 107, 204	31.1
Improved land..... acres.	6, 707, 328	25.7
Timber and cut-over land..... acres.	956, 894	3.7
Other unimproved land..... acres.	442, 982	1.7
Total capital invested in and required for completion of operating enterprises..	\$30, 771, 620	100.0
Capital invested in these enterprises to Dec. 31, 1919.....	\$30, 680, 145	99.7
Additional capital required to complete these enterprises.....	\$91, 475	0.3

OHIO

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



DRAINAGE ON FARMS.

Explanation of terms.—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which are substantially as follows:

Drainage of agricultural land was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purpose of improving the condition of the soil and crops.

The area provided with drainage, in farms, is the acreage actually benefited or made of more value for agricultural purposes by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land not now suitable for crops which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators have answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual." Levee districts, however, generally are not included in the enterprises for which data are given in this bulletin (see definition of drainage enterprises, below).

Farms and farm land.—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for growing crops by reason of the drainage. This is to be distinguished from the area merely provided with outlet facilities by organized drainage enterprises. Drainage on farms represents in most cases the result of work done by the farm owner, either independently or supplemental to the work done by a drainage enterprise, but the acreage would include also any farm land receiving similar benefits directly from the works of an enterprise.

DRAINAGE ENTERPRISES.

Explanation of terms.—The more important terms used in connection with the census of drainage enterprises were defined as follows:

Drainage enterprises comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swamp or overflowed land for sale, other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditches or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise, though the capacities of drainage pumping plants are given only in the counties in which the plants are located.

Operating enterprises, as designated in this bulletin, are those that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

Land in drainage enterprises comprises the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises, deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (a) improved land; (b) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (c) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be considerably greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprises.

Timber and cut-over land includes farm woodland of natural or

planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, land subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering loss of crops is intended to include only land devoted to planted crops which suffer damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A **pumping district** is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include some that on the census date had completed their plans, sold bonds to cover the cost of the undertaking, and let contracts for construction work, and also others for which orders of establishment had just been issued and which were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. ¹		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	8,147,546	100.0	\$30,707,863	100.0	\$307,396
Operating enterprises.....	8,107,204	99.5	30,680,145	99.9	91,475
With works completed.....	8,093,994	99.3	30,636,857	99.8	91,475
With works under construction.	13,210	0.2	43,288	0.1	
Nonoperating enterprises.....	40,342	0.5	27,718	0.1	305,921

¹ The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—A very large part of the northwest quarter of Ohio has been included in organized drainage enterprises. A large acreage in the southwest quarter also has been included in such enterprises, and a considerable amount in the northeast section, but almost none in the southeast part of the state. The approximate location and extent of the enterprises are shown by the map on page 2.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	8,147,546	100.0	\$30,707,863	100.0	\$307,396
Operating enterprises.....	8,107,204	99.5	30,680,145	99.9	91,475
Wabash River.....	122,660	1.5	621,880	2.0	
Miami River.....	1,304,841	16.0	5,838,633	19.0	30,570
Scioto River.....	1,556,510	19.1	4,491,241	14.5	1,630
Ohio River.....	277,350	3.4	1,385,843	4.5	9,908
Lake Erie.....	4,845,043	59.5	18,372,548	59.8	40,367
Nonoperating enterprises.....	40,342	0.5	27,718	0.1	305,921
Miami River.....	3,450	(1)	2,297	(1)	5,951
Scioto River.....	4,304	0.1	3,494	(1)	40,639
Ohio River.....	272	(1)	3,316	(1)	2,848
Lake Erie.....	31,810	0.4	18,611	0.1	256,453

¹ Less than one-tenth of 1 per cent.

Condition of land in enterprises.—Approximately seven-eighths of the operating drainage enterprises, in number and in acreage, were reported as organized for the reclamation or improvement of land generally swampy or too wet for cultivation with profit; most of the others were reported as organized for securing protection against overflow by stream floods. The estimates of the condition of the land before drainage show 50 per cent of the total area in the enterprises to have been improved, and 37 per cent timbered or cut-over; the area reported as having been swampy, wet, or subject to overflow is 39 per cent of the total area in the enterprises.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflows for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	8,107,204	100.0	8,093,994	13,210	40,342
Improved land.....	6,707,328	82.7	6,697,080	10,248	24,375
Timber and cut-over land.....	956,894	11.8	955,107	1,787	4,393
Other unimproved land.....	442,982	5.5	441,807	1,175	11,604
Swampy or subject to overflow...	247,273	3.1	243,662	3,311	19,776
Suffering a loss of crops.....	141,481	1.7	140,059	1,422	7,603

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered as a separate enterprise. In this way 24,871 operating drainage enterprises are counted in Ohio, with an average area of 943 acres assessed. Of this number, 191 comprise 10,000 acres or more each; 5,372 others comprise 1,000 acres or more; and 19,308 embrace less than 1,000 acres each, of which 6,231 are smaller than 200 acres.

The assessed acreage exceeds the land in enterprises by 15,357,608 acres, which is the amount of overlapping and probably represents largely reassessments for enlarging, extending, or reconstructing ditches. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed area, the net amount of overlapping with enterprises organized previously was deducted, to determine the area to be tabulated as land in enterprises. The amount of overlapping

could be only estimated, however, in a great number of cases, so for many of the northwestern counties the figures for land in enterprises are only rough approximations.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

SIZE GROUP.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	8,107,204	23,464,812	100.0
Less than 200 acres.....	418,913	658,953	2.8
200 to 499 acres.....	1,274,879	2,495,996	10.6
500 to 999 acres.....	1,625,720	3,928,812	16.7
1,000 to 4,999 acres.....	3,288,121	9,615,229	41.0
5,000 to 9,999 acres.....	823,323	2,850,517	12.1
10,000 to 49,999 acres.....	571,127	3,152,280	13.4
50,000 acres to 99,999.....	105,121	763,025	3.3

Character of enterprises.—Most of the drainage enterprises in Ohio are county ditches established according to an act passed April 12, 1871. There are also considerable numbers of county ditches, joint county ditches, and township ditches established under other drainage laws of the state, and a very few interstate county ditches and large undertakings by individual landowners. These "ditches" include all forms of drains and watercourses constructed or improved under the provisions of the laws. An act passed June 19, 1919, codifies all the ditch laws of the state and repeals the earlier forms without changing the general character of the enterprises.

The law of 1919 provides that ditches or drains may be established by the board of county commissioners of the county in which is situated the land that will be affected by the proposed improvement upon petition from one or more owners of such land, from the trustees of a township, or from any public corporation, board, or institution. A preliminary survey and estimates are made by the county engineer, and public hearing upon the petition then is held by the county commissioners. The drain is established upon finding that it is necessary or will be advantageous. Claims for damages are determined by the commissioners. Final orders of the board are subject to appeal to the common pleas court. The drainage plan and the apportionment of cost are made by the engineer. The cost is assessed against the land in proportion to benefits; the assessments are equalized and confirmed by the commissioners, and then are appealable to the common pleas court. The assessments are to be paid in 10 semiannual installments. Construction of the drainage works is under the supervision of the county engineer. The commissioners may issue bonds to finance the improvement. If petition for the drain is signed by the county commissioners, the proceedings for establishment are in charge of the court of common pleas. If the land to be affected by a

drain is situated in more than one county, the commissioners of the counties affected act upon the petition jointly. The act provides that right of way for a private drain across the land of an objecting owner may be obtained through petition to the trustees of the township and payment of the damages awarded by them.

An act of March 24, 1859, authorized the establishment of ditches by the county commissioners upon petition from one or more landowners. It provided that damages claimed should be determined by the probate court, and that the construction work should be allotted to the landowners, in proportion to benefits, by an engineer appointed by the commissioners. Contracts for unfinished work were let by the county auditor. An act of March 27, 1861, was substantially similar.

The act of April 12, 1871, superseded all earlier county ditch laws and remained in effect until 1919. The ditches were established by order of the county commissioners of the county in which the ditch was located. Ditches in more than one county were established by joint action of the commissioners of the counties affected. Petition for a ditch had to be made by one or more owners of land to be benefited, and public hearing be held before the enterprise was established. Plans and estimates for the work were made by the county surveyor or by an engineer appointed by the commissioners. Claims for damages were determined by the commissioners, subject to appeal to the probate court. Construction of the drain was apportioned among the landowners in proportion to benefits, by the commissioners; contracts for work not performed by the owners were let by the county auditor. The costs were paid by the county, which was reimbursed by taxes levied against the land benefited. The issue of bonds for drainage was authorized by an act of April 29, 1873, and an act of April 20, 1881, required that the engineer should make assessments of the total cost for consideration with his plans and estimates.

Joint county ditches providing drainage for land in more than one county are specially authorized by an act of June 12, 1911. The petition for establishment under this law must be signed by 50 or more interested persons. Establishment is ordered by the joint action of the commissioners of the counties affected. Plans and estimates for the improvement are made by the county surveyors jointly. The cost is apportioned among the counties by joint action of the county boards, and each county surveyor makes the assessments against the land in his county. Claims for damages are determined and contracts for construction are let by the county boards jointly. Each county may issue joint county ditch bonds to run not longer than 20 years.

Interstate county ditches, which will benefit land in an adjoining state also, are authorized by an act of

March 21, 1887. Upon petition from one or more landowners the county commissioners may meet jointly with the county officials of the adjoining state to consider the petition, to locate the improvement, and to apportion the costs between the states. The ditch then is constructed and the cost apportioned as for a county drain wholly within this state. Damages allowed are paid from the county fund. An act of 1898 authorizes the boards of county commissioners to enter into agreements with county officials in adjoining states to secure drainage outlets in those states or to provide such outlet facilities for land in those states.

Township ditches have been established under several statutes. The act of February 24, 1853, authorized the establishment of public ditches by the township trustees upon petition from one or more owners of land that would be benefited and after investigation of the necessity for the drain, subject to appeal to the probate judge. Damages were determined by the trustees, who also apportioned the work of construction to the landowners benefited. An act of May 1, 1862, also provided for the establishment of public drains by the township trustees upon petition from one or more landowners. Damages claimed were determined by jury in the probate court. The cost was apportioned by the trustees according to benefits, and each landowner might pay his assessment in labor. An act of May 6, 1868, was similar to that of May 1, 1862.

The greater part of the township ditches were established under an act of April 18, 1874, which was in effect until 1919. This law authorized the establishment of ditches by the township trustees upon application from one or more owners of land adjacent to the proposed drain, after public hearing. Plans for the improvement were made and claims for damages were determined by the trustees, who also apportioned the work of construction among the landowners according to benefits. Appeals from decisions of the trustees regarding the utility or location of the ditch and the awards of damages might be taken to the probate court for jury trial. For work not performed within the specified time, contract was let by the trustees and the cost was charged to the delinquent landowners. Ditches in two or more townships might be established by joint action of the trustees of those townships, under an act of April 19, 1898. A great many amendments to the act of 1874 have been made, but the character of the enterprises has not been changed.

The first general drainage law of Ohio was an act of February 8, 1847, authorizing the establishment of drains by the county commissioners upon petition from one or more interested landowners. Viewers were appointed to locate the ditch and assess damages. By an amendment in 1851, the viewers also assessed benefits against the land. When the petitioners had paid the damages and constructed the ditch, they might collect the benefits as confirmed by the commissioners. A township ditch law of

May 1, 1854, was similar to that of February 24, 1853. Both of these laws were repealed by the county ditch law of March 24, 1859. An act of March 2, 1853, authorized the county commissioners to drain the swamp land granted to the state by Congress, payment to be made from funds realized from the sale of that land. This act was repealed April 13, 1894. No drainage enterprises were reported as organized under these and other acts relating to drainage, including the conservancy act of February 17, 1914. Conservancy districts are established by courts of common pleas upon petition from 500 freeholders in the proposed district, or from a majority of all in number, acreage, or value. The officers are three directors appointed by the court.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	8,147,546	100.0	\$39,707,863	100.0	\$397,396
Operating enterprises.....	8,107,204	99.5	39,689,145	99.9	91,475
County ditches.....	7,719,293	94.7	29,283,427	95.4	83,099
Act of Mar. 24, 1859.....	257,382	3.2	338,710	1.2	.....
Act of Mar. 27, 1861.....	804,999	9.9	1,565,324	5.1	.....
Act of Apr. 12, 1871.....	6,656,912	81.7	27,359,393	89.1	83,099
Joint county ditches.....	78,863	1.0	442,013	1.4	8,376
Interstate county ditches.....	5,474	0.1	44,459	0.1	.....
Township ditches.....	192,993	2.4	564,463	1.8	.....
Act of Feb. 24, 1853.....	960	(1)	890	(1)	.....
Act of May 1, 1862.....	2,895	(1)	8,768	(1)	.....
Act of May 6, 1868.....	11,344	0.1	25,627	0.1	.....
Act of Apr. 18, 1874.....	177,794	2.2	529,208	1.7	.....
Individual ownership.....	7,736	0.1	138,875	0.5	.....
Not identified.....	102,995	1.3	206,908	0.7	.....
Act of 1881.....	100,990	1.2	182,926	0.6	.....
Not reporting.....	1,915	(1)	23,982	0.1	.....
Nonoperating enterprises.....	40,342	0.5	27,718	0.1	305,921
County ditches.....	40,342	0.5	27,718	0.1	305,921
Act of Apr. 12, 1871.....	16,275	0.2	19,497	0.1	196,583
Act of June 12, 1911.....	24,067	0.3	8,221	(1)	109,333

¹ Less than one-tenth of 1 per cent.

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 24,984.0 miles of open ditches, 9,205.3 miles of tile drains, and 9.6 miles of accessory levees; the additional lengths under construction were 13.4 miles of open ditches, 8.3 miles of tile drains, and 4.0 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of open ditches or tile drains. It is possible that some duplication of open ditches is included, by reason of reconstruction work being reported as new work, though every effort was made to avoid or eliminate such duplication.

There are four small pumping districts among the operating drainage enterprises in this state. The total acreage served by pumps, wholly or partly, is 1,755 acres; the total capacities of the pumps and engines are 3,600 gallons per minute and 125 horsepower, respectively.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	8,107,204	100.0	\$30,680,145	100.0	\$91,475
Open ditches only.....	4,738,114	58.4	15,357,021	50.1	3,610
Open ditches and levees.....	7,078	0.1	25,089	0.1	25,000
Tile drains only.....	1,139,856	14.1	5,993,113	19.5	4,585
Open ditches and tile drains.....	2,219,770	27.4	9,226,031	30.1	58,280
Open ditches, tile drains, and levees.....	2,386	(1)	78,000	0.3	

¹ Less than one-tenth of 1 per cent.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of outlet reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet were omitted because it seemed that they did not represent so well the average depths of outlet provided for all the farms in those districts. To include this group, computed as 3 feet, would show the mean depth for the state 3.8 instead of 3.9 feet.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	8,107,204	100.0
Less than 3 feet.....	342,681	4.2
3.0 to 3.9 feet.....	792,424	9.8
4.0 to 4.9 feet.....	569,745	7.0
5.0 to 5.9 feet.....	201,340	3.6
6.0 to 6.9 feet.....	150,733	1.9
7.0 to 7.9 feet.....	1,692	(1)
8.0 to 8.9 feet.....	9,535	0.1
Not reporting branches.....	5,949,051	73.4

¹ Less than one-tenth of 1 per cent.

Maintenance of works.—The act of June 19, 1919, provides that county ditches constructed under that and earlier acts are to be maintained by the county commissioners of the respective counties. The cost is to be assessed against the land in the same ratio as

the cost for original construction. If there be no record of the original apportionment, however, a new assessment of benefits shall be made the same as for constructing a new improvement, such assessment being subject to appeal as for a new drain. Joint county ditches are to be maintained by joint action of the county commissioners concerned.

The county drain law of 1871 authorized the election of a township ditch supervisor by the electors of each township, to keep the ditches in repair, and the township ditch law of 1874 authorized the township trustees to keep the ditches in repair. An act of April 2, 1906, required that the township ditch supervisor divide the county and township ditches into sections which he should allot to the various landowners, corporate roads, railroads, townships, and counties according to benefits. If any person or corporation failed to keep his allotted section in good repair, the supervisor was authorized to let contract for the work and the cost would be placed upon the tax roll. Provision also was made in the statutes for undertaking repair of ditches by proceedings like those for constructing new ditches, and the information secured in the canvass indicates that this method was generally followed.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	8,107,204	100.0	\$30,680,145	100.0	\$91,475
By district forces.....	30,172	0.4	85,599	0.3	9,908
By contract.....	1,000,205	24.5	7,780,408	25.4	810
By method not specified.....	28,956	0.4	73,215	0.2	
By landowners.....	23,216	0.3	122,245	0.4	
No maintenance provided.....	5,912,000	72.9	22,232,863	72.5	80,157
Not reported.....	121,664	1.5	385,815	1.3	600

Date of organization.—The progress in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the ditches were established by the county commissioners or township trustees, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large enterprise. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	8,107,204	100.0	23,464,812	100.0
Before 1860.....	89,203	1.1	90,003	0.4
1860 to 1869.....	721,132	8.9	864,879	3.7
1870 to 1879.....	1,411,044	17.4	2,065,032	11.4
1880 to 1889.....	2,219,818	27.4	5,008,785	21.3
1890 to 1899.....	1,405,162	17.3	5,710,986	24.3
1900 to 1904.....	563,795	7.0	2,950,124	12.6
1905 to 1909.....	751,494	9.3	2,971,538	12.7
1910 to 1914.....	493,418	6.1	1,802,952	7.7
1915 to 1919.....	449,782	5.5	1,377,043	5.9
Not reported.....	2,356	(¹)	17,470	0.1

¹ Less than one-tenth of 1 per cent.

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES. CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$30,680,145	100.0	\$91,475
Before 1860.....	154,702	0.5	.....
1860 to 1869.....	1,276,392	4.2	.....
1870 to 1879.....	4,218,515	13.7	.....
1880 to 1889.....	6,024,473	21.6	.....
1890 to 1899.....	5,609,118	18.3	810
1900 to 1904.....	2,941,011	9.6	.....
1905 to 1909.....	4,158,050	13.6	.....
1910 to 1914.....	2,920,876	9.5	.....
1915 to 1919.....	2,749,993	9.0	90,665
Not reported.....	27,015	0.1	.....

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

	THE STATE.	Adams.	Allen.	Ashland.	Ash- tabula.	Athens.	Auglaize.	Belmont.	
1	Number of all farms in the state or county.....	256,695	3,650	2,909	2,512	4,801	2,503	2,626	3,565
2	Farms reporting land having drainage.....	130,117	48	2,721	1,403	1,100	162	2,341	142
3	Farms reporting land needing drainage.....	85,326	212	1,687	934	1,027	195	1,734	349
4	Farms in drainage and levee districts.....	7,315	14	40	92	70	70	70	70
LAND AND FARM AREA.									
5	Approximate land area of the state or county.....acres..	26,073,600	349,440	259,840	260,440	462,720	311,680	254,080	339,200
6	All land in farms.....acres..	23,515,888	321,892	241,488	252,142	381,320	256,974	240,568	307,034
7	Improved land in farms.....acres..	18,542,353	214,375	205,577	190,956	252,635	187,006	203,146	235,708
8	Woodland in farms.....acres..	3,198,929	83,942	31,357	30,579	68,750	42,792	30,837	37,345
9	Other unimproved land in farms.....acres..	1,774,606	23,575	4,554	24,607	59,935	26,276	6,585	34,881
10	Farm land reported as provided with drainage.....acres..	7,365,532	1,121	173,347	48,699	22,374	2,240	162,293	1,617
11	Farm land reported as needing drainage.....acres..	2,014,889	2,771	42,715	22,082	30,348	4,631	42,672	4,135
12	Drainage only.....acres..	886,557	605	17,333	13,338	7,361	1,281	13,253	1,397
13	Drainage and clearing.....acres..	1,128,332	2,166	25,382	8,744	22,987	3,350	29,419	2,738

	Brown.	Butler.	Carroll.	Cham- paign.	Clark.	Cler- mont.	Clinton.	Colum- biana.	Coshoc- ton.	
1	Number of all farms in the county.....	3,890	2,534	1,990	2,481	2,487	3,803	2,411	3,586	2,951
2	Farms reporting land having drainage.....	526	1,178	247	1,543	1,548	168	1,019	1,411	591
3	Farms reporting land needing drainage.....	429	729	470	706	790	208	804	1,204	624
4	Farms in drainage and levee districts.....	14	18	.....	218	46	76	26	18	11
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	307,840	289,280	247,080	269,440	260,480	297,600	263,040	341,760	357,120
6	All land in farms.....acres..	302,391	272,248	229,597	258,168	241,540	276,070	256,686	288,847	337,542
7	Improved land in farms.....acres..	263,652	216,656	171,031	221,010	204,277	230,319	231,732	213,157	259,156
8	Woodland in farms.....acres..	23,860	26,562	32,484	24,349	19,083	24,118	19,896	40,255	46,481
9	Other unimproved land in farms.....acres..	14,879	29,030	25,182	12,809	18,180	21,633	5,058	35,435	31,905
10	Farm land reported as provided with drainage.....acres..	26,956	52,676	2,837	117,490	100,562	8,253	129,658	29,900	8,452
11	Farm land reported as needing drainage.....acres..	5,067	18,998	8,853	20,894	18,668	2,229	14,668	22,504	9,376
12	Drainage only.....acres..	519	13,074	5,546	6,537	7,778	323	4,891	11,216	5,752
13	Drainage and clearing.....acres..	4,548	5,924	3,307	14,357	10,890	1,906	9,777	11,288	3,624

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	24,997.4	100.0	9,213.6	100.0	13.6	100.0
Before 1860.....	160.2	0.6	4.2	(¹)	.....	.....
1860 to 1869.....	2,202.7	8.8	46.5	0.5	.....	.....
1870 to 1879.....	4,778.0	19.1	316.4	3.4	.....	.....
1880 to 1889.....	7,168.0	28.7	1,285.9	14.0	0.5	3.7
1890 to 1899.....	5,067.5	20.3	2,056.0	22.3	.....	.....
1900 to 1904.....	1,890.2	7.6	1,413.5	15.3	6.5	47.8
1905 to 1909.....	1,903.1	7.6	1,850.2	20.1	0.3	2.2
1910 to 1914.....	1,068.0	4.3	1,265.7	13.7	1.5	11.0
1915 to 1919.....	736.9	2.9	967.5	10.5	4.8	35.3
Not reported.....	22.8	0.1	7.7	0.1	.....	.....

¹ Less than one-tenth of 1 per cent.

Crops.—The principal crops grown upon the drained land in drainage enterprises are corn, wheat, and hay. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE—OHIO.

9

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Craw- ford.	Cuya- hoga.	Darke.	Defiance.	Dela- ware.	Erie.	Fairfield.	Fayette.	Frank- lin.
1	Number of all farms in the county.....	2,415	3,375	5,456	2,522	2,922	1,883	3,437	1,787	3,778
2	Farms reporting land having drainage.....	2,275	1,186	4,870	2,032	2,445	1,963	2,391	1,623	3,033
3	Farms reporting land needing drainage.....	1,487	558	2,394	1,304	1,569	508	1,180	675	1,095
4	Farms in drainage and levee districts.....	78	139	84	203	474	73	136	129	61
LAND AND FARM AREA.										
5	Approximate land area of the county..... acres..	261,760	286,320	375,040	259,200	284,800	163,840	316,800	264,320	330,880
6	All land in farms..... acres..	241,332	173,742	370,061	243,593	275,734	140,771	307,007	249,700	296,733
7	Improved land in farms..... acres..	201,748	113,700	330,473	195,583	229,500	117,102	263,868	235,262	265,116
8	Woodland in farms..... acres..	32,107	28,969	33,256	37,708	39,588	12,396	28,208	11,661	19,303
9	Other unimproved land in farms..... acres..	7,477	31,073	6,932	10,302	6,580	11,274	14,931	2,777	12,234
10	Farm land reported as provided with drainage..... acres..	148,022	22,627	280,280	114,728	136,563	65,773	130,930	176,246	189,062
11	Farm land reported as needing drainage..... acres..	40,814	0,568	33,583	30,818	51,807	13,721	21,943	18,866	26,107
12	Drainage only..... acres..	14,508	3,280	7,050	8,841	28,410	9,651	11,343	9,767	13,243
13	Drainage and clearing..... acres..	26,306	6,288	26,533	21,877	23,388	3,770	10,598	9,099	12,864
		Fulton.	Gallia.	Geauga.	Greene.	Guern- sey.	Hamil- ton.	Han- cock.	Hardin.	Harris- son.
1	Number of all farms in the county.....	3,156	2,963	2,570	2,373	3,079	3,741	3,214	3,052	2,039
2	Farms reporting land having drainage.....	2,929	275	739	1,454	300	270	3,024	2,887	341
3	Farms reporting land needing drainage.....	1,726	490	914	520	434	161	1,986	1,672	466
4	Farms in drainage and levee districts.....	478	2	44	58	.....	5	1	301	1
LAND AND FARM AREA.										
5	Approximate land area of the county..... acres..	259,200	287,360	266,240	265,600	331,520	260,480	342,400	302,720	256,640
6	All land in farms..... acres..	248,052	265,536	232,818	247,759	308,943	183,776	317,894	289,727	238,887
7	Improved land in farms..... acres..	210,611	196,936	119,586	213,797	240,804	140,431	272,711	245,764	186,517
8	Woodland in farms..... acres..	29,794	42,854	47,524	22,901	42,230	17,784	37,676	34,143	29,893
9	Other unimproved land in farms..... acres..	7,647	25,746	65,708	11,061	16,909	25,561	7,507	9,820	22,477
10	Farm land reported as provided with drainage..... acres..	168,120	4,713	10,967	103,728	6,122	5,897	225,257	218,802	6,378
11	Farm land reported as needing drainage..... acres..	42,603	10,708	27,854	11,256	11,405	2,746	54,423	49,627	8,956
12	Drainage only..... acres..	19,133	4,729	8,723	4,726	5,797	1,694	21,609	16,696	4,539
13	Drainage and clearing..... acres..	23,470	5,979	19,131	6,530	5,608	1,052	32,814	32,831	4,417
		Henry.	High- land.	Hock- ing.	Holmes.	Huron.	Jackson.	Jeffer- son.	Knox.	Lake.
1	Number of all farms in the county.....	2,891	3,338	1,753	2,546	2,728	2,654	1,866	3,108	1,771
2	Farms reporting land having drainage.....	2,623	1,103	228	770	1,798	264	38	1,217	767
3	Farms reporting land needing drainage.....	1,534	516	428	610	708	244	131	1,148	478
4	Farms in drainage and levee districts.....	14	45	1	4	82	6	.....	7	160
LAND AND FARM AREA.										
5	Approximate land area of the county..... acres..	264,960	351,360	263,040	267,520	316,160	258,560	290,480	328,320	154,240
6	All land in farms..... acres..	253,093	346,283	208,674	258,743	283,224	229,203	214,930	322,509	115,819
7	Improved land in farms..... acres..	222,539	296,186	135,754	194,824	221,146	161,433	142,094	237,674	77,721
8	Woodland in farms..... acres..	23,159	39,138	50,298	44,116	34,818	45,069	40,784	40,210	21,326
9	Other unimproved land in farms..... acres..	7,395	10,959	22,022	19,808	27,760	22,121	32,052	24,325	16,772
10	Farm land reported as provided with drainage..... acres..	191,095	53,118	5,774	10,978	96,483	6,755	355	41,993	18,543
11	Farm land reported as needing drainage..... acres..	31,580	10,702	8,192	9,515	17,603	10,919	2,240	23,538	10,498
12	Drainage only..... acres..	13,274	3,111	1,003	7,011	7,203	6,668	607	13,407	4,752
13	Drainage and clearing..... acres..	18,306	7,691	6,580	2,504	10,400	10,251	1,543	10,131	5,746
		Law- rence.	Lick- ing.	Logan.	Lorain.	Lucas.	Madi- son.	Mahon- ing.	Marion.	Medina.
1	Number of all farms in the county.....	2,430	4,138	2,825	3,425	2,744	1,769	2,555	1,997	3,018
2	Farms reporting land having drainage.....	129	2,423	2,212	1,942	1,214	1,432	1,043	1,896	1,829
3	Farms reporting land needing drainage.....	590	1,885	1,212	987	508	694	863	959	1,543
4	Farms in drainage and levee districts.....	13	49	225	228	192	140	17	15	83
LAND AND FARM AREA.										
5	Approximate land area of the county..... acres..	283,520	428,160	288,640	318,080	218,880	318,080	273,280	261,760	278,400
6	All land in farms..... acres..	194,910	405,111	274,008	278,195	152,750	289,550	209,056	243,373	249,572
7	Improved land in farms..... acres..	128,241	336,594	221,877	209,119	126,991	261,094	135,712	216,995	178,097
8	Woodland in farms..... acres..	45,017	43,965	33,977	34,950	16,354	21,937	35,427	21,223	43,400
9	Other unimproved land in farms..... acres..	21,652	24,552	19,154	34,126	9,414	6,519	37,917	5,155	28,075
10	Farm land reported as provided with drainage..... acres..	2,516	116,315	142,831	61,687	54,262	203,352	21,867	194,221	55,164
11	Farm land reported as needing drainage..... acres..	14,228	49,522	34,815	22,747	10,261	33,232	26,224	25,168	32,492
12	Drainage only..... acres..	1,948	28,019	14,950	8,778	4,602	18,442	12,892	11,864	11,950
13	Drainage and clearing..... acres..	12,280	21,503	19,865	13,969	5,650	14,810	13,332	13,304	20,542

DRAINAGE—OHIO.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920—Continued.

		Meigs.	Mercer.	Miami.	Monroe.	Montgomery.	Morgan.	Morrow.	Muskingum.	Noble.
1	Number of all farms in the county.....	2,833	3,040	3,260	3,062	4,460	2,378	2,570	3,688	2,576
2	Farms reporting land having drainage.....	258	2,871	2,598	23	3,072	213	2,362	527	81
3	Farms reporting land needing drainage.....	426	1,741	925	279	1,276	350	1,898	803	182
4	Farms in drainage and levee districts.....		70	231		94	1	87	0	3
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	263,680	288,000	261,120	286,720	291,200	257,280	257,920	424,960	255,360
6	All land in farms.....acres..	247,377	276,716	247,273	267,944	260,307	249,034	259,345	382,152	241,936
7	Improved land in farms.....acres..	170,185	236,050	217,956	190,589	221,331	198,213	187,461	324,151	204,370
8	Woodland in farms.....acres..	49,050	34,223	16,785	52,798	21,908	33,783	44,213	51,906	27,235
9	Other unimproved land in farms.....acres..	28,136	5,843	12,532	24,557	17,073	17,038	7,671	16,095	10,301
10	Farm land reported as provided with drainage.....acres..	3,144	193,128	155,869	367	119,301	2,733	106,770	8,529	1,152
11	Farm land reported as needing drainage.....acres..	5,523	39,976	15,307	3,877	25,237	5,874	53,858	14,000	3,943
12	Drainage only.....acres..	2,449	17,689	6,401	179	13,466	2,732	24,708	5,015	1,042
13	Drainage and clearing.....acres..	3,074	21,991	8,906	3,098	11,771	3,092	20,150	9,051	2,001
		Ottawa.	Paulding.	Perry.	Pickaway.	Pike.	Portage.	Preble.	Putnam.	Richland.
1	Number of all farms in the county.....	2,010	2,414	2,355	2,151	1,940	3,406	3,095	3,232	3,123
2	Farms reporting land having drainage.....	1,494	2,225	527	1,748	104	1,800	2,666	3,114	2,008
3	Farms reporting land needing drainage.....	925	1,217	398	833	163	1,742	1,462	2,001	1,338
4	Farms in drainage and levee districts.....	74	21	32	53	9	126	649	240	25
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	172,800	264,320	255,360	313,600	273,920	333,440	266,240	308,480	321,620
6	All land in farms.....acres..	138,750	246,265	218,578	308,497	220,343	286,070	263,918	292,620	299,138
7	Improved land in farms.....acres..	117,214	220,913	162,287	285,124	123,165	181,419	217,971	259,691	232,453
8	Woodland in farms.....acres..	11,906	19,751	28,967	15,013	32,728	48,320	28,681	28,114	46,056
9	Other unimproved land in farms.....acres..	9,570	5,601	27,324	8,360	23,450	56,322	17,266	4,815	20,129
10	Farm land reported as provided with drainage.....acres..	77,111	184,350	18,528	179,600	2,775	33,946	162,170	233,253	90,459
11	Farm land reported as needing drainage.....acres..	16,915	35,398	8,211	19,680	6,749	30,856	30,863	46,697	24,108
12	Drainage only.....acres..	7,988	18,837	4,903	9,884	3,245	14,821	14,045	22,437	9,800
13	Drainage and clearing.....acres..	8,927	16,561	3,308	9,796	3,504	25,035	16,818	24,260	14,308
		Ross.	Sandusky.	Scioto.	Seneca.	Shelby.	Stark.	Summit.	Trumbull.	Tuscarawas.
1	Number of all farms in the county.....	2,949	2,713	2,762	3,113	2,624	4,628	2,529	3,911	3,264
2	Farms reporting land having drainage.....	855	2,270	180	2,210	2,356	2,164	1,136	1,220	900
3	Farms reporting land needing drainage.....	862	1,428	330	1,357	1,432	1,831	1,126	1,138	859
4	Farms in drainage and levee districts.....	14	4	9	222	68	161	15	28	20
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	427,520	264,320	398,720	352,000	264,320	362,240	261,120	465,120	355,200
6	All land in farms.....acres..	384,328	264,267	283,237	332,132	245,769	328,911	204,210	339,510	312,604
7	Improved land in farms.....acres..	272,680	202,451	127,250	279,747	210,359	264,306	147,850	267,909	237,849
8	Woodland in farms.....acres..	52,479	20,820	122,059	38,135	24,983	33,465	32,718	61,776	41,442
9	Other unimproved land in farms.....acres..	29,109	16,977	33,928	14,250	10,427	31,140	23,636	60,825	23,313
10	Farm land reported as provided with drainage.....acres..	57,962	140,076	6,596	136,688	172,283	55,086	26,534	27,202	15,533
11	Farm land reported as needing drainage.....acres..	23,701	42,132	14,674	32,339	34,165	30,858	23,569	37,687	14,648
12	Drainage only.....acres..	6,698	26,078	1,217	11,796	15,044	16,192	9,726	16,366	8,531
13	Drainage and clearing.....acres..	17,003	15,154	13,757	20,543	19,121	14,666	13,813	21,321	6,117
		Union.	Van Wert.	Vinton.	Warren.	Washington.	Wayne.	Williams.	Wood.	Wyandot.
1	Number of all farms in the county.....	2,736	2,879	1,598	2,584	4,204	3,044	2,810	4,164	2,264
2	Farms reporting land having drainage.....	2,400	2,802	144	948	154	2,502	2,601	2,361	2,083
3	Farms reporting land needing drainage.....	1,448	1,809	181	403	209	1,703	1,959	1,363	1,421
4	Farms in drainage and levee districts.....	130	11	1	15	1	126	283	242	95
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	285,440	259,840	263,680	264,320	403,200	356,480	263,040	391,680	259,840
6	All land in farms.....acres..	263,830	252,450	193,108	250,348	368,064	333,049	257,685	356,882	245,297
7	Improved land in farms.....acres..	227,016	224,192	118,874	199,255	242,079	268,129	207,475	316,979	211,971
8	Woodland in farms.....acres..	27,844	24,704	50,215	30,203	67,333	46,371	28,914	30,266	21,674
9	Other unimproved land in farms.....acres..	8,970	3,554	24,019	20,890	58,652	19,440	21,296	9,637	11,652
10	Farm land reported as provided with drainage.....acres..	176,124	206,702	2,823	40,361	1,795	75,237	144,642	166,778	159,780
11	Farm land reported as needing drainage.....acres..	47,715	38,357	2,915	6,152	2,791	38,629	42,420	36,723	33,064
12	Drainage only.....acres..	26,382	15,774	1,934	2,409	1,119	18,561	16,919	22,981	12,418
13	Drainage and clearing.....acres..	21,333	22,583	981	3,743	1,672	20,068	25,501	13,742	20,646

DRAINAGE—OHIO.

11

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

	THE STATE.	Allen.	Ashland.	Ash- tabula.	Auglaize.	Cham- paign.	Clark.	Clinton.	Craw- ford.
LAND AREA.									
1	Approximate land area of the state or county.....acres..	26,073,600	259,840	269,440	402,720	254,080	269,440	260,480	263,040
2	All land in operating drainage enterprises.....acres..	8,107,204	225,015	9,189	18,962	240,934	156,191	19,505	20,040
3	Improved land.....acres..	6,707,328	175,350	7,867	9,081	201,399	145,464	13,949	13,949
4	Per cent of all improved land in farms.....	86.2	85.3	4.1	3.6	99.1	65.8	6.8	8.6
5	Timber and cut-over land.....acres..	956,894	35,833	264	3,269	32,505	8,113	297	10,543
6	Other unimproved land.....acres..	442,982	13,832	1,058	6,612	6,940	2,614	5,259	10,801
7	Swampy or subject to overflow, in enterprises.....acres..	247,273	24,724	1,192	1,442	27,753	2,555	784	895
8	Suffering a loss of crops from defective drainage.....acres..	141,451	7,857	1,192	394	23,634	2,393	733	186
9	Assessed acreage.....	23,464,812	468,980	13,190	18,962	515,318	210,963	29,754	20,040
10	Excess over all land in operating enterprises.....acres..	15,357,608	243,965	4,001		274,384	51,762	10,249	162,998
DRAINAGE WORKS.									
11	Open ditches:								
12	Completed.....miles.....	24,984.0	527.3	49.1	48.4	437.6	150.8	65.2	15.4
13	Additional under construction.....miles.....	13.4	2.9				1.2		
14	Maximum completed in any enterprise.....miles.....	44.1	10.0	12.6	4.1	23.2	13.2	7.0	6.6
15	Maximum width at bottom of ditch.....feet.....	125	12	6	6	12	36	35	4
16	Maximum of average depths of outlet ditches.....feet.....	18.0	8.5	10.0	5.5	12.0	17.0	8.0	7.0
17	Mean depth of branch ditches.....feet.....	3.9	3.9	6.2	3.0	4.0	4.7	3.4	5.9
18	Tile drains:								
19	Completed.....miles.....	9,205.3	161.3	1.4	1.2	346.7	147.4	47.7	27.5
20	Additional under construction.....miles.....	8.3	0.6			1.6	1.1		
21	Maximum completed in any enterprise.....miles.....	50.0	4.8	0.5	0.8	16.6	3.9	2.5	3.3
22	Maximum size of tile.....inches.....	60	27	9	18	48	32	24	27
23	Accessory levees and dikes:								
24	Completed.....miles.....	9.6						1.2	
25	Additional under construction.....miles.....	4.0							
26	Pumping plants:								
27	Engine capacity.....horsepower.....	125							
28	Pump capacity.....gallons per minute.....	3,600							
29	Area served by pumps.....acres.....	1,755							
30	Area drained by open ditches only.....acres.....	4,738,114	132,171	8,280	18,779	92,987	70,004	6,860	48,389
31	Length of these ditches.....miles.....	19,924.4	354.8	48.2	48.2	231.1	96.1	41.6	222.6
32	Average length per acre.....feet.....	22.2	14.2	30.7	13.6	13.1	7.2	32.0	24.3
33	Area having open ditches and levees.....acres.....	7,078						1,000	
34	Length of these ditches.....miles.....	11.1						1.5	
35	Average length per acre.....feet.....	8.3						7.0	
36	Length of accessory levees.....miles.....	6.8						1.2	
37	Area drained by tile only.....acres.....	1,139,850	13,092	209	57	26,825	26,911	4,404	5,871
38	Length of these tiles.....miles.....	5,274.7	65.0	1.2	0.4	205.7	72.0	23.9	14.4
39	Average length per acre.....feet.....	24.4	26.6	30.3	37.1	40.5	14.2	28.7	13.0
40	Area drained by open ditches and tile.....acres.....	2,219,770	79,752	700	126	121,122	59,276	7,241	14,169
41	Length of these drains.....miles.....	8,933.4	271.4	1.1	1.0	349.1	131.8	45.0	28.5
42	Average length per acre.....feet.....	21.2	18.0	8.3	41.9	15.2	11.7	33.5	10.6
43	Area having open ditches, tile drains, and levees.....acres.....	2,380							
44	Length of these drains.....miles.....	67.4							
45	Average length per acre.....feet.....	140.2							
46	Length of accessory levees.....miles.....	6.8							
DEVELOPMENT OF LAND.									
47	Improved land in operating enterprises, 1920.....acres.....	6,707,328	175,350	7,867	9,081	201,399	145,464	13,949	20,040
48	Improved land prior to drainage.....acres.....	3,055,220	70,648	4,653	8,121	150,105	110,542	10,380	18,329
49	Increase since drainage.....acres.....	2,752,108	104,702	3,214	960	42,294	34,922	3,569	1,711
50	Per cent of increase.....	69.6	148.2	69.1	11.8	26.6	31.6	34.6	9.3
51	Per cent increase is of all improved land in farms, 1920.....	14.8	50.9	1.7	0.4	20.8	15.8	1.8	0.7
52	Timber and cut-over land, 1920.....acres.....	956,894	35,833	264	3,269	32,505	8,113	297	10,543
53	Timber and cut-over land prior to drainage.....acres.....	3,070,180	133,933	1,594	3,319	69,581	13,381	1,929	695
54	Decrease since drainage.....acres.....	2,122,286	98,100	1,330	50	36,986	5,268	1,632	695
55	Per cent of decrease.....	68.9	73.2	83.4	1.5	53.2	39.4	84.6	100.0
56	Other unimproved land, 1920.....acres.....	442,982	13,832	1,058	6,612	6,940	2,614	5,259	10,801
57	Other unimproved land prior to drainage.....acres.....	1,072,904	20,434	2,942	7,522	12,248	32,268	7,216	1,016
58	Decrease since drainage.....acres.....	629,922	6,602	1,884	910	5,308	29,654	1,957	1,016
59	Per cent of decrease.....	58.7	32.3	64.0	12.1	43.3	91.9	27.1	100.0
60	Swampy or subject to overflow, 1920.....acres.....	247,273	24,724	1,192	1,442	27,753	2,555	784	895
61	Swampy or subject to overflow prior to drainage.....acres.....	3,126,885	158,960	4,463	16,610	105,070	54,233	2,693	9,862
62	Decrease since drainage.....acres.....	2,879,612	134,236	3,271	15,168	77,317	51,698	1,879	9,862
63	Per cent of decrease.....	92.1	84.4	73.3	91.3	73.6	95.3	70.6	100.0
CAPITAL INVESTED AND COST PER ACRE.									
64	Total capital invested in and required for completion of operating enterprises.....dollars.....	30,771,620	600,915	58,700	71,989	1,012,994	533,092	133,225	39,251
65	Capital invested in these enterprises to Dec. 31, 1919.....dollars.....	30,680,145	581,915	58,700	71,989	1,003,034	521,301	133,225	39,251
66	Additional capital required to complete these enterprises.....dollars.....	91,475	19,000			3,960	11,791		
67	Average cost per acre when completed.....dollars.....	3.80	2.67	6.39	3.80	4.20	3.41	6.83	1.96
68	Enterprises constructing open ditches only.....dollars.....	15,360,631	214,464	59,316	66,514	213,828	235,820	41,344	89,657
69	Average cost per acre when completed.....dollars.....	3.24	1.62	6.80	3.54	2.30	3.37	6.03	1.85
70	Enterprises constructing open ditches and levees.....dollars.....	50,080						9,267	
71	Average cost per acre when completed.....dollars.....	7.08						9.27	
72	Enterprises constructing tile drains only.....dollars.....	5,997,698	78,062	897	208	273,796	90,697	28,239	16,073
73	Average cost per acre when completed.....dollars.....	5.26	5.96	4.20	5.23	10.21	3.37	6.41	2.74
74	Enterprises constructing open ditches and tile drains.....dollars.....	9,285,211	308,389	1,487	5,147	525,370	206,575	54,375	23,178
75	Average cost per acre when completed.....dollars.....	4.18	3.87	2.12	40.85	4.34	3.48	7.51	1.64
76	Enterprises constructing open ditches, tile drains, and levees.....dollars.....	78,000							
77	Average cost per acre when completed.....dollars.....	32.60							
CROPS.									
78	Improved land in enterprises reporting—								
79	Corn as principal crop on drained land.....acres.....	6,309,143	168,810			201,399	138,710	13,915	20,040
80	Wheat as principal crop on drained land.....acres.....	248,186	6,351				1,021		
81	Hay as principal crop on drained land.....acres.....	126,815		7,867	9,081				
82	Vegetables as principal crop on drained land.....acres.....	14,883					417	34	
83	Oats as principal crop on drained land.....acres.....	4,741					4,707		
84	Other crops as principal ones on drained land.....acres.....	201							
85	Not reporting principal crop on drained land.....acres.....	3,359	189						770

¹ Office estimate; the figures reported exceed the improved acreage in all farms in the county as determined by the census of agriculture.² When works under construction have been completed.³ The figures reported have been reduced by the same acreage as the improved land, 1920.

DRAINAGE—OHIO.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Cuya- hoga.	Darke.	Defiance.	Dela- ware.	Erie.	Fair- field.	Fayette.	Franklin.	Fulton.	
LAND AREA.											
1	Approximate land area of the county.....	acres..	296,320	375,040	259,200	284,800	163,840	316,800	264,320	330,880	250,200
2	All land in operating drainage enterprises.....	acres..	8,519	346,125	250,267	272,530	102,251	5,655	96,478	33,045	257,047
3	Improved land.....	acres..	6,284	314,643	104,430	227,865	99,804	5,405	89,195	25,121	208,640
4	Per cent of all improved land in farms.....	per cent.	5.5	85.2	40.4	80.3	3.3	1.7	33.0	7.5	99.1
5	Timber and cut-over land.....	acres..	496	31,482	47,301	40,597	644	250	7,283	1,320	47,594
6	Other unimproved land.....	acres..	1,739	8,536	4,068	1,803	.....	.....	.....	6,595	813
7	Swampy or subject to overflow, in enterprises.....	acres..	240	4,353	2,433	2,591	1,696	.....	1,777	512	3,191
8	Suffering a loss of crops from defective drainage.....	acres..	90	4,365	2,405	2,567	.....	.....	1,590	452	3,191
9	Assessed acreage.....	acres..	12,234	842,868	843,361	426,090	149,381	5,655	96,478	45,051	1,513,486
10	Excess over all land in operating enterprises.....	acres..	3,715	496,743	593,094	153,560	47,130	.....	.....	12,006	1,256,439
DRAINAGE WORKS.											
11	Open ditches.....	miles..	54.4	534.0	1,075.2	240.3	274.2	14.7	48.4	67.3	1,616.7
12	Completed.....	miles..	1.1	.....	.....	.....	.....	.....	.....	0.3	.....
13	Additional under construction.....	miles..	11.0	15.0	28.1	14.5	11.0	8.0	9.7	5.0	20.2
14	Maximum completed in any enterprise.....	feet..	16	60	10	10	20	65	6	50	25
15	Maximum width at bottom of ditch.....	feet..	4.5	10.0	7.4	6.0	12.0	9.0	8.0	5.5	8.5
16	Maximum of average depths of outlet ditches.....	feet..	3.0	4.6	3.3	3.0	3.3	6.0	.....	3.0	4.0
17	Mean depth of branch ditches.....	feet..	.....	.....	.....	.....	.....	.....	.....	.....	.....
18	Tile drains.....	miles..	.....	559.5	104.5	371.7	36.6	1.4	220.1	30.9	244.6
19	Completed.....	miles..	1.3	.....	.....	.....	.....	.....	.....	.....	.....
20	Additional under construction.....	miles..	.....	5.3	10.0	6.8	2.4	1.0	7.2	2.6	7.1
21	Maximum completed in any enterprise.....	feet..	.....	24	30	30	18	15	24	48	20
22	Maximum size of tile.....	inches..	.....	.....	.....	.....	.....	.....	.....	.....	.....
23	Accessory levees and dikes.....	miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	Completed.....	miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	Additional under construction.....	miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	Pumping plants.....	horsepower..	.....	.....	.....	.....	.....	.....	.....	.....	.....
27	Engine capacity.....	gallons per minute..	.....	.....	.....	.....	.....	.....	.....	.....	.....
28	Pump capacity.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
29	Area served by pumps.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
30	Area drained by open ditches only.....	acres..	8,219	113,654	235,135	62,131	36,487	4,560	8,615	21,284	194,713
31	Length of these ditches.....	miles..	53.8	338.6	867.7	137.3	245.5	14.7	20.5	64.2	1,248.1
32	Average length per acre.....	feet..	34.6	15.7	10.5	11.7	15.0	17.0	12.6	15.9	33.8
33	Area having open ditches and levees.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
34	Length of these ditches.....	miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....
35	Average length per acre.....	feet..	.....	.....	.....	.....	.....	.....	.....	.....	.....
36	Length of accessory levees.....	miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....
37	Area drained by tile only.....	acres..	.....	56,860	(*)	70,358	5,481	1,095	58,822	9,394	7,693
38	Length of these tile.....	miles..	.....	277.3	19.9	180.4	20.7	1.4	178.0	32.2	104.7
39	Average length per acre.....	feet..	.....	25.7	.....	13.5	19.9	6.8	16.1	18.1	70.0
40	Area drained by open ditches and tile.....	acres..	300	175,611	15,132	140,041	10,283	.....	29,041	2,367	54,441
41	Length of these drains.....	miles..	3.0	477.0	292.1	304.1	44.6	.....	69.1	11.1	508.5
42	Average length per acre.....	feet..	52.8	14.4	.....	11.5	22.9	.....	12.6	24.8	49.3
43	Area having open ditches, tile drains, and levees.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
44	Length of these drains.....	miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....
45	Average length per acre.....	feet..	.....	.....	.....	.....	.....	.....	.....	.....	.....
46	Length of accessory levees.....	miles..	.....	.....	.....	.....	.....	.....	.....	.....	.....
DEVELOPMENT OF LAND.											
47	Improved land in operating enterprises, 1920.....	acres..	6,284	314,643	104,430	227,865	99,804	5,405	89,195	25,121	208,640
48	Improved land prior to drainage.....	acres..	4,170	221,459	68,402	140,154	80,939	2,901	82,502	19,968	118,340
49	Increase since drainage.....	acres..	2,114	93,184	126,028	87,711	18,865	2,504	6,693	5,153	90,290
50	Per cent of increase.....	per cent.	50.7	42.1	184.2	62.6	23.3	86.3	8.1	25.8	76.2
51	Per cent increase is of all improved land in farms, 1920.....	per cent.	1.9	28.2	64.4	38.2	16.1	0.9	2.8	1.0	42.0
52	Timber and cut-over land, 1920.....	acres..	496	31,482	47,301	40,597	644	250	7,283	1,320	47,594
53	Timber and cut-over land prior to drainage.....	acres..	969	124,666	157,437	119,939	7,597	675	11,801	4,661	124,336
54	Decrease since drainage.....	acres..	473	93,184	110,136	79,342	6,953	425	4,518	3,332	76,742
55	Per cent of decrease.....	per cent.	48.8	74.7	70.0	66.2	91.5	63.0	38.3	71.5	61.7
56	Other unimproved land, 1920.....	acres..	1,739	8,536	4,068	1,803	.....	.....	.....	6,595	813
57	Other unimproved land prior to drainage.....	acres..	3,380	24,428	12,437	13,715	2,079	2,175	8,416	14,331	13,518
58	Decrease since drainage.....	acres..	1,641	15,892	8,369	11,912	2,079	2,175	1,821	13,518	13,518
59	Per cent of decrease.....	per cent.	48.6	65.1	67.3	86.9	100.0	100.0	21.6	94.3	94.3
60	Swampy or subject to overflow, 1920.....	acres..	240	4,353	2,433	2,591	1,696	.....	1,777	512	3,191
61	Swampy or subject to overflow prior to drainage.....	acres..	6,135	108,186	42,810	41,220	52,280	2,029	94,303	2,510	55,851
62	Decrease since drainage.....	acres..	5,895	103,833	40,377	38,629	50,593	2,029	92,526	1,998	52,660
63	Per cent of decrease.....	per cent.	96.1	96.0	94.3	93.7	96.8	100.0	98.1	79.6	94.3
CAPITAL INVESTED AND COST PER ACRE.											
64	Total capital invested in and required for completion of operating enterprises.....	dollars..	64,872	2,000,005	651,468	617,685	250,199	99,364	274,691	120,982	1,012,572
65	Capital invested in these enterprises to Dec. 31, 1919.....	dollars..	53,872	2,000,005	651,468	616,455	250,199	99,364	274,691	120,582	1,012,572
66	Additional capital required to complete these enterprises.....	dollars..	11,000	.....	.....	1,230	.....	.....	.....	400	.....
67	Average cost per acre when completed.....	dollars..	7.61	5.78	2.60	2.27	2.45	17.57	2.85	3.66	3.94
68	Enterprises constructing open ditches only.....	dollars..	50,872	551,942	437,309	100,887	194,438	97,083	7,428	61,098	576,044
69	Average cost per acre when completed.....	dollars..	6.19	4.86	1.86	1.62	2.25	21.29	0.86	2.90	2.96
70	Enterprises constructing open ditches and levees.....	dollars..	.....	.....	.....	.....	.....	.....	.....	.....	.....
71	Average cost per acre when completed.....	dollars..	.....	.....	.....	.....	.....	.....	.....	.....	.....
72	Enterprises constructing tile drains only.....	dollars..	.....	450,495	19,467	167,703	21,283	2,281	167,405	44,990	102,030
73	Average cost per acre when completed.....	dollars..	.....	7.92	.....	2.38	3.88	2.08	2.85	4.79	12.93
74	Enterprises constructing open ditches and tile drains.....	dollars..	14,000	997,658	104,702	349,095	34,478	.....	90,858	14,294	334,598
75	Average cost per acre when completed.....	dollars..	46.67	5.68	.....	2.49	3.55	.....	3.44	6.04	6.15
76	Enterprises constructing open ditches, tile drains, and levees.....	dollars..	.....	.....	.....	.....	.....	.....	.....	.....	.....
77	Average cost per acre when completed.....	dollars..	.....	.....	.....	.....	.....	.....	.....	.....	.....
CROPS.											
78	Improved land in enterprises reporting—	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
79	Corn as principal crop on drained land.....	acres..	.....	314,643	194,430	227,865	99,783	5,405	89,195	24,679	208,640
80	Wheat as principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
81	Hay as principal crop on drained land.....	acres..	6,284	.....	.....	.....	.....	.....	.....	67	.....
82	Vegetables as principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	.....	.....	375	.....
83	Oats as principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
84	Other crops as principal ones on drained land.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....
85	Not reporting principal crop on drained land.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....	.....

* Office estimate; the figures reported exceed the improved acreage in all farms in the county as determined by the census of agriculture.

* When works under construction have been completed.

* Area reported under "open ditches and tile."

* Additional area reported under "open ditches only."

* The figures reported have been reduced by the same acreage as the improved land, 1920.

DRAINAGE—OHIO.

13

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Greene.	Hancock.	Hardin.	Henry.	Huron.	Licking.	Logan.	Lorain.	Lucas.	
LAND AREA.											
1	Approximate land area of the county.....	acres.	265,600	342,400	302,720	264,900	316,100	428,160	288,640	318,080	218,880
2	All land in operating drainage enterprises.....	acres.	46,685	341,627	299,610	202,707	92,411	19,305	175,061	113,761	205,244
3	Improved land.....	acres.	43,660	270,205	245,442	220,591	90,575	16,987	172,258	64,001	124,644
4	Per cent of all improved land in farms.....		20.4	99.1	99.9	99.1	41.0	5.0	77.6	30.6	98.2
5	Timber and cut-over land.....	acres.	2,232	35,919	36,639	42,116	839	1,050	2,539	14,443	61,776
6	Other unimproved land.....	acres.	793	35,503	17,529	32	997	1,268	264	35,317	18,824
7	Swampy or subject to overflow, in enterprises.....	acres.	832	26,906	5,311	32	316	2,162	1,246	4,281	13,877
8	Suffering a loss of crops from defective drainage.....	acres.	772	18	244	111	111	2,162	1,175	133	13,883
9	Assessed acreage.....		97,825	2,060,025	891,290	1,963,587	92,471	23,809	268,271	160,827	589,405
10	Excess over all land in operating enterprises.....	acres.	51,140	1,718,395	591,680	1,700,880	60	4,504	93,210	47,066	384,161
DRAINAGE WORKS.											
11	Open ditches:										
12	Completed.....	miles.	70.4	969.1	537.9	2,109.1	249.3	17.2	393.8	731.0	569.1
13	Additional under construction.....	miles.				1.0			0.5		
14	Maximum completed in any enterprise.....	miles.	7.7	12.9	19.4	30.0	10.6	2.9	10.8	44.1	30.0
15	Maximum width at bottom of ditch.....	feet.	18	12	36	20	30	5	20	20	40
16	Maximum of average depths of outlet ditches.....	feet.	8.0	8.3	14.0	8.0	10.0	4.0	15.0	6.0	10.0
17	Mean depth of branch ditches.....	feet.		4.3	4.2	3.9	3.5	3.0	4.1	3.1	5.3
18	Tile drains:										
19	Completed.....	miles.	39.1	627.2	588.1	22.5	107.9	40.4	470.8	22.0	68.7
20	Additional under construction.....	miles.							0.7		
21	Maximum completed in any enterprise.....	miles.	3.7	5.8	9.0	3.0	3.0	3.0	7.0	2.6	50.0
22	Maximum size of tile.....	inches.	24	27	24	42	24	28	30	24	60
23	Accessory levees and dikes:								0.8		6.8
24	Completed.....	miles.									
25	Additional under construction.....	miles.									
26	Pumping plants:										
27	Engine capacity.....	horsepower.									100
28	Pump capacity.....	gallons per minute.									3,100
29	Area served by pumps.....	acres.									1,500
30	Area drained by open ditches only.....	acres.	23,121	195,310	191,531	260,187	40,595	7,702	72,675	108,999	200,823
31	Length of these ditches.....	miles.	69.1	567.5	326.5	2,074.7	155.9	11.7	229.8	703.6	554.8
32	Average length per acre.....	feet.	15.8	15.3	9.0	42.1	20.3	8.0	16.7	34.1	14.6
33	Area having open ditches and levees.....	acres.							1,612		
34	Length of these ditches.....	miles.							4.3		
35	Average length per acre.....	feet.							14.1		
36	Length of accessory levees.....	miles.							0.8		
37	Area drained by tile only.....	acres.	12,768	10,003	24,812	4,490	11,733	6,942	47,677	1,244	512
38	Length of these tile.....	miles.	24.2	362.2	333.6	10.7	45.4	32.4	275.0	11.3	3.1
39	Average length per acre.....	feet.	10.0	71.0	71.0		20.4	24.6	30.5	48.0	32.0
40	Area drained by open ditches and tile.....	acres.	10,796	136,314	83,267	2,030	40,083	4,661	53,097	3,518	1,523
41	Length of these drains.....	miles.	22.2	606.6	465.9	47.2	155.9	13.5	356.7	38.1	12.5
42	Average length per acre.....	feet.	10.9	25.8	29.5		20.5	15.3	35.5	57.2	43.3
43	Area having open ditches, tile drains, and levees.....	acres.									2,386
44	Length of these drains.....	miles.									67.4
45	Average length per acre.....	feet.									149.2
46	Length of accessory levees.....	miles.									6.8
DEVELOPMENT OF LAND.											
47	Improved land in operating enterprises, 1920.....	acres.	43,660	270,205	245,442	220,591	90,575	16,987	172,258	64,001	124,644
48	Improved land prior to drainage.....	acres.	42,577	26,157	167,419	92,153	67,587	9,198	67,331	28,483	51,933
49	Increase since drainage.....	acres.	1,083	244,048	78,023	128,438	22,978	7,789	104,927	35,518	72,651
50	Per cent of increase.....		2.5	933.0	46.6	139.4	84.7	155.8	155.8	124.7	159.7
51	Per cent increase is of all improved land in farms, 1920.....		0.5	89.5	31.7	57.7	10.4	2.3	47.3	17.0	57.2
52	Timber and cut-over land, 1920.....	acres.	2,232	35,919	36,639	42,116	839	1,050	2,539	14,443	61,776
53	Timber and cut-over land prior to drainage.....	acres.	2,881	276,776	102,937	169,599	9,835	4,804	107,155	26,109	122,902
54	Decrease since drainage.....	acres.	649	240,857	66,298	127,483	8,996	3,754	104,016	11,657	61,126
55	Per cent of decrease.....		22.5	87.0	64.4	75.2	61.5	78.1	97.6	44.7	49.7
56	Other unimproved land, 1920.....	acres.	793	35,503	17,529	32	997	1,268	264	35,317	18,824
57	Other unimproved land prior to drainage.....	acres.	1,227	38,694	29,254	955	14,079	5,303	575	59,178	30,349
58	Decrease since drainage.....	acres.	434	3,191	11,725	955	13,982	4,035	311	23,861	11,525
59	Per cent of decrease.....		35.4	8.2	40.1	100.0	93.3	70.1	54.1	40.3	38.0
60	Swampy or subject to overflow, 1920.....	acres.	832	26,906	5,311	32	316	2,162	1,246	4,281	13,877
61	Swampy or subject to overflow prior to drainage.....	acres.	3,286	289,937	103,239	44,000	36,469	9,712	35,739	113,217	46,249
62	Decrease since drainage.....	acres.	2,454	263,031	97,928	43,968	36,153	7,550	34,493	108,936	32,372
63	Per cent of decrease.....		74.7	90.7	94.0	99.9	99.1	77.7	96.5	96.2	70.0
CAPITAL INVESTED AND COST PER ACRE.											
64	Total capital invested in and required for completion of operating enterprises.....	dollars.	114,190	1,527,173	1,128,506	1,799,959	335,825	75,749	874,267	456,376	565,851
65	Capital invested in these enterprises to Dec. 31, 1919.....	dollars.	114,190	1,527,173	1,128,506	1,799,149	335,825	75,749	873,048	456,376	565,851
66	Additional capital required to complete these enterprises.....	dollars.				810			1,219		2,76
67	Average cost per acre when completed.....	dollars.	2.45	4.47	3.77	6.85	3.63	3.92	4.99	4.01	2.76
68	Enterprises constructing open ditches only.....	dollars.	51,968	494,289	411,310	1,736,764	149,516	8,226	270,219	393,914	467,714
69	Average cost per acre when completed.....	dollars.	2.25	2.53	2.15	6.68	3.08	1.07	3.72	3.61	2.33
70	Enterprises constructing open ditches and levees.....	dollars.							3,195		
71	Average cost per acre when completed.....	dollars.							1.98		
72	Enterprises constructing tile drains only.....	dollars.	35,674	402,999	298,113	14,736	39,392	46,899	285,785	22,627	4,387
73	Average cost per acre when completed.....	dollars.	2.79		12.01		3.36	6.76	5.99	18.19	8.57
74	Enterprises constructing open ditches and tile drains.....	dollars.	20,518	629,885	419,083	48,459	146,917	20,624	315,068	39,835	15,750
75	Average cost per acre when completed.....	dollars.	2.46	4.62	5.03		3.07	4.42	5.93	11.32	10.34
76	Enterprises constructing open ditches, tile drains, and levees.....	dollars.									78,000
77	Average cost per acre when completed.....	dollars.									32.69
CROPS.											
78	Improved land in enterprises reporting—										
79	Corn as principal crop on drained land.....	acres.	43,660	269,708	242,003	220,591	89,647	16,987	172,258	1,670	122,058
80	Wheat as principal crop on drained land.....	acres.			2,962		82			3,000	
81	Hay as principal crop on drained land.....	acres.					846			58,731	
82	Vegetables as principal crop on drained land.....	acres.									2,588
83	Oats as principal crop on drained land.....	acres.									
84	Other crops as principal ones on drained land.....	acres.									
85	Not reporting principal crop on drained land.....	acres.		497	477						

1 Office estimate; the figures reported exceed the improved acreage in all farms in the county as determined by the census of agriculture.

2 When works under construction have been completed.

3 Additional area reported under "open ditches only."

4 The figures reported have been reduced by the same acreage as the improved land, 1920.

DRAINAGE—OHIO.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—(Continued).

		Madison.	Marion.	Medina.	Mercer.	Miami.	Montgomery.	Morrow.	Ottawa.	Paulding.	
LAND AREA.											
1	Approximate land area of the county.....	acres.....	318,080	261,760	278,400	288,000	261,120	291,200	257,920	172,800	264,320
2	All land in operating drainage enterprises.....	acres.....	236,431	237,580	17,859	250,853	225,720	10,482	111,111	154,402	262,911
3	Improved land.....	acres.....	214,306	174,142	10,753	222,988	202,613	9,308	97,763	110,177	129,885
4	Per cent of all improved land in farms.....		82.1	80.3	6.0	94.2	93.0	4.2	52.2	94.0	99.5
5	Timber and cut-over land.....	acres.....	14,528	24,142	1,729	27,865	668	776	5,913	40,240	41,012
6	Other unimproved land.....	acres.....	7,597	39,296	5,377		22,439	398	7,435	3,985	2,014
7	Swampy or subject to overflow, in enterprises.....	acres.....	15	5,057	130	5,619	536	152	7,454	690	8,230
8	Suffering loss of crops from defective drainage.....	acres.....	64	4,828	109	5,359	28	84	5,820		4,923
9	Assessed acreage.....		252,359	465,386	19,544	515,191	281,021	11,008	325,012	441,699	1,131,331
10	Excess over all land in operating enterprises.....	acres.....	15,928	227,805	1,085	264,338	55,301	526	213,901	287,297	808,420
DRAINAGE WORKS.											
11	Open ditches:										
12	Completed.....	miles.....	261.8	407.7	44.5	569.6	153.3	10.5	104.6	652.8	1,551.8
13	Additional under construction.....	miles.....									
14	Maximum completed in any enterprise.....	miles.....	10.0	10.7	4.6	33.3	8.5	3.8	9.2	19.6	21.0
15	Maximum width at bottom of ditch.....	feet.....	12	12	24	125	18	13	9	40	15
16	Maximum of average depths of outlet ditches.....	feet.....	7.0	12.0	10.0	13.9	7.0	7.0	8.0	8.1	11.0
17	Mean depth of branch ditches.....	feet.....	3.6	3.0	3.0	4.3	3.9		3.3	4.4	4.1
18	Tile drains:										
19	Completed.....	miles.....	515.5	488.3	0.8	190.4	490.3	27.3	138.1	4.0	78.7
20	Additional under construction.....	miles.....									
21	Maximum completed in any enterprise.....	miles.....	16.5	11.2	0.3	4.0	6.3	2.4	4.4	1.4	3.4
22	Maximum size of tile.....	inches.....	24	27	8	42	42	27	24	12	30
23	Accessory levees and dikes:										
24	Completed.....	miles.....								0.3	
25	Additional under construction.....	miles.....									
26	Pumping plants:										
27	Engine capacity.....	horsepower.....									25
28	Pump capacity.....	gallons per minute.....									500
29	Area served by pumps.....	acres.....									255
30	Area drained by open ditches only.....	acres.....	37,532	58,752	17,648	148,960	79,100	4,359	26,349	153,255	248,130
31	Length of these ditches.....	miles.....	101.7	141.4	42.8	431.7	86.0	10.5	42.7	650.6	1,465.4
32	Average length per acre.....	feet.....	14.3	12.7	12.8	15.3	5.7	12.7	8.6	22.4	31.2
33	Area having open ditches and levees.....	acres.....									350
34	Length of these ditches.....	miles.....									0.5
35	Average length per acre.....	feet.....									7.5
36	Length of accessory levees.....	miles.....									0.3
37	Area drained by tile only.....	acres.....	74,759	60,405	20	36,606	78,368	6,123	25,079	227	330
38	Length of these tile.....	miles.....	250.9	288.0	0.3	123.0	337.8	27.3	66.8	1.9	39.3
39	Average length per acre.....	feet.....	17.7	25.2	79.2	17.7	22.8	28.5	14.1	44.2	
40	Area drained by open ditches and tile.....	acres.....	124,140	118,423	191	65,287	68,252		59,683	570	14,451
41	Length of these drains.....	miles.....	424.7	466.6	2.2	205.3	219.8		133.2	3.8	123.8
42	Average length per acre.....	feet.....	18.1	20.8	60.8	16.6	17.0		11.8	35.2	46.0
43	Area having open ditches, tile drains, and levees.....	acres.....									
44	Length of these drains.....	miles.....									
45	Average length per acre.....	feet.....									
46	Length of accessory levees.....	miles.....									
DEVELOPMENT OF LAND.											
47	Improved land in operating enterprises, 1920.....	acres.....	214,306	174,142	10,753	222,988	202,613	9,308	97,763	110,177	129,885
48	Improved land prior to drainage.....	acres.....	120,773	98,099	7,173	159,035	200,834	8,829	60,263	70,297	75,811
49	Increase since drainage.....	acres.....	93,533	75,533	3,580	63,953	1,779	479	31,500	39,880	144,074
50	Per cent of increase.....		77.4	76.6	40.9	40.2	0.9	5.4	47.5	56.7	190.0
51	Per cent increase is of all improved land in farms, 1920.....		35.8	34.8	2.0	27.0	0.8	0.2	16.8	34.0	65.2
52	Timber and cut-over land, 1920.....	acres.....	14,528	24,142	1,729	27,865	668	776	5,913	40,240	41,012
53	Timber and cut-over land prior to drainage.....	acres.....	68,515	87,721	2,273	91,818	2,015	1,165	18,578	41,025	184,142
54	Decrease since drainage.....	acres.....	53,987	63,579	544	63,953	1,347	389	12,665	785	143,130
55	Per cent of decrease.....		78.8	72.5	23.9	69.7	66.9	33.4	68.2	1.9	77.7
56	Other unimproved land, 1920.....	acres.....	7,597	39,296	5,377		22,439	398	7,435	3,985	2,014
57	Other unimproved land prior to drainage.....	acres.....	47,143	51,250	8,413		22,871	488	26,270	43,080	2,958
58	Decrease since drainage.....	acres.....	39,546	11,954	3,036		432	90	18,835	39,095	914
59	Per cent of decrease.....		83.9	23.3	36.1		1.9	18.4	71.7	90.7	31.9
60	Swampy or subject to overflow, 1920.....	acres.....	15	5,057	130	5,619	536	152	7,454	690	8,230
61	Swampy or subject to overflow prior to drainage.....	acres.....	94,970	45,730	15,819	65,502	8,994	793	29,205	69,491	94,289
62	Decrease since drainage.....	acres.....	94,955	40,673	15,689	59,883	8,458	641	21,751	68,801	86,059
63	Per cent of decrease.....		100.0	88.9	99.2	91.4	94.0	80.8	74.5	99.0	91.3
CAPITAL INVESTED AND COST PER ACRE.											
64	Total capital invested in and required for completion of operating enterprises.....	dollars.....	686,563	706,480	65,430	898,792	884,625	54,685	224,268	441,719	1,037,071
65	Capital invested in these enterprises to Dec. 31, 1919.....	dollars.....	686,563	706,480	65,430	898,792	884,625	54,685	224,268	441,719	1,037,071
66	Additional capital required to complete these enterprises.....	dollars.....									
67	Average cost per acre when completed.....	dollars.....	2.90	2.97	3.66	3.58	3.92	5.22	2.02	2.86	3.94
68	Enterprises constructing open ditches only.....	dollars.....	62,355	87,765	63,560	501,455	128,729	9,535	24,304	433,240	910,592
69	Average cost per acre when completed.....	dollars.....	1.66	1.49	3.60	3.37	1.63	2.19	0.92	2.83	3.67
70	Enterprises constructing open ditches and levees.....	dollars.....									
71	Average cost per acre when completed.....	dollars.....									
72	Enterprises constructing tile drains only.....	dollars.....	248,930	252,894	392	161,235	460,957	45,150	70,389	771	43,844
73	Average cost per acre when completed.....	dollars.....	3.33	4.19	19.60	4.40	5.88	7.37	2.81	3.40	
74	Enterprises constructing open ditches and tile drains.....	dollars.....	375,278	365,821	1,478	236,102	294,939		129,675	2,108	82,635
75	Average cost per acre when completed.....	dollars.....	3.02	3.09	7.74	3.62	4.32		2.17	3.70	5.72
76	Enterprises constructing open ditches, tile drains, and levees.....	dollars.....									
77	Average cost per acre when completed.....	dollars.....									
CROPS.											
78	Improved land in enterprises reporting—										
79	Corn as principal crop on drained land.....	acres.....	210,722	174,142		222,988	202,399	9,308	97,763	14,877	219,187
80	Wheat as principal crop on drained land.....	acres.....	3,584		435					95,117	
81	Hay as principal crop on drained land.....	acres.....			10,818					171	
82	Vegetables as principal crop on drained land.....	acres.....									
83	Oats as principal crop on drained land.....	acres.....					34				
84	Other crops as principal ones on drained land.....	acres.....								12	
85	Not reporting principal crop on drained land.....	acres.....					180				698

¹ Office estimate; the figures reported exceed the improved acreage in all farms in the county as determined by the census of agriculture.

² When works under construction have been completed.

³ Additional area reported under "open ditches only."

⁴ The figures reported have been reduced by the same acreage as the improved land, 1920.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Pick- away.	Portage.	Preble.	Putnam.	Richland.	San- dusky.	Seneca.	Shelby.	Stark.	
LAND AREA.											
1	Approximate land area of the county.....	acres..	313,600	333,440	266,240	308,480	321,920	264,320	352,000	264,320	362,240
2	All land in operating drainage enterprises.....	acres..	24,101	10,274	110,615	308,374	22,768	250,307	327,618	247,498	14,639
3	Improved land.....	acres..	20,680	2,508	106,000	253,803	18,411	186,005	273,028	207,043	8,621
4	Per cent of all improved land in farms.....		7.3	1.4	48.9	97.7	7.9	91.9	97.6	98.4	3.3
5	Timber and cut-over land.....	acres..	1,534	1,317	4,009	39,510	2,555	25,976	37,759	28,987	39
6	Other unimproved land.....	acres..	1,887	6,449	15,061	1,797	38,326	16,831	11,468	5,979	
7	Swampy or subject to overflow, in enterprises.....	acres..	2,049	2,381	4,105	34,614	1,620	1,126	1,940	5,208	667
8	Suffering a loss of crops from defective drainage.....	acres..	1,240		4,068	4,520	1,175	1,150	700	4,327	573
9	Assessed acreage.....		32,085	11,836	119,570	1,598,583	35,190	508,883	423,775	369,776	18,966
10	Excess over all land in operating enterprises.....	acres..	7,994	1,562	8,955	1,290,209	12,427	258,576	96,157	122,278	4,327
DRAINAGE WORKS.											
11	Open ditches:										
12	Completed.....	miles..	32.1	84.8	48.4	1,339.9	53.9	851.2	775.3	357.3	167.9
13	Additional under construction.....	miles..					1.9			2.7	
14	Maximum completed in any enterprise.....	miles..	12.4	9.6	5.2	13.8	5.1	17.2	12.0	13.2	14.9
15	Maximum width at bottom of ditch.....	feet..	18	12	10	30	30	40	30	18	12
16	Maximum of average depths of outlet ditches.....	feet..	5.0	8.0	6.5	10.0	8.0	8.5	8.1	10.0	8.0
17	Mean depth of branch ditches.....	feet..		4.0	3.7	3.9	3.3	3.3	3.5		4.0
18	Tile drains:										
19	Completed.....	miles..	37.5	0.2	404.0	229.3	24.5	31.8	148.9	312.5	11.3
20	Additional under construction.....	miles..					1.6				
21	Maximum completed in any enterprise.....	miles..	9.1	0.2	4.1	4.0	3.4	1.6	6.0	6.1	1.9
22	Maximum size of tile.....	inches..	20	8	27	27	30	30	24	34	30
23	Accessory levees and dikes:										
24	Completed.....	miles..									
25	Additional under construction.....	miles..								4.0	
26	Pumping plants:										
27	Engine capacity.....	horsepower..									
28	Pump capacity.....	gallons per minute..									
29	Area served by pumps.....	acres..									
30	Area drained by open ditches only.....	acres..	13,299	9,725	10,256	245,239	11,955	230,389	203,074	84,351	9,800
31	Length of these ditches.....	miles..	28.5	79.7	12.1	1,169.2	49.6	806.4	629.4	235.5	108.8
32	Average length per acre.....	feet..	11.3	43.3	6.2	25.2	21.9	18.5	16.4	14.7	58.6
33	Area having open ditches and levees.....	acres..								2,500	
34	Length of these ditches.....	miles..								4.0	
35	Average length per acre.....	feet..								8.4	
36	Length of accessory levees.....	miles..								4.0	
37	Area drained by tile only.....	acres..	9,254		72,020	17,185	5,547	3,322	44,047	63,100	274
38	Length of these tile.....	miles..	33.4		392.6	120.6	13.4	18.0	85.3	194.6	2.4
39	Average length per acre.....	feet..	19.1		28.8	37.1	12.8	28.6	10.2	16.3	46.2
40	Area drained by open ditches and tile.....	acres..	1,548	549	28,339	45,950	5,261	16,596	80,497	97,547	4,565
41	Length of these drains.....	miles..	7.7	5.3	107.7	279.4	18.9	58.6	209.5	238.4	68.0
42	Average length per acre.....	feet..	26.3	51.0	20.1	32.1	19.0	18.6	13.7	12.9	78.7
43	Area having open ditches, tile drains, and levees.....	acres..									
44	Length of these drains.....	miles..									
45	Average length per acre.....	feet..									
46	Length of accessory levees.....	miles..									
DEVELOPMENT OF LAND.											
47	Improved land in operating enterprises, 1920.....	acres..	20,680	2,508	106,606	253,803	18,411	186,005	273,028	207,043	8,621
48	Improved land prior to drainage.....	acres..	14,873	2,255	82,481	63,477	12,371	121,434	216,228	180,704	315
49	Increase since drainage.....	acres..	5,807	2,253	24,125	200,326	6,040	64,571	56,800	26,339	8,306
50	Per cent of increase.....		39.0	88.5	29.2	374.6	48.8	33.2	28.3	14.6	
51	Per cent increase is of all improved land in farms, 1920.....		2.0	1.2	11.1	77.1	2.6	31.9	20.3	12.5	3.1
52	Timber and cut-over land, 1920.....	acres..	1,534	1,317	4,009	39,510	2,555	25,976	37,759	28,987	39
53	Timber and cut-over land prior to drainage.....	acres..	4,037	1,539	28,134	236,623	4,290	50,358	42,009	47,516	1,252
54	Decrease since drainage.....	acres..	2,503	222	24,125	197,113	1,735	24,382	4,250	18,529	1,213
55	Per cent of decrease.....		62.0	14.4	85.8	83.3	40.4	48.4	10.1	39.0	96.9
56	Other unimproved land, 1920.....	acres..	1,887	6,449		15,061	1,797	38,326	16,831	11,468	5,979
57	Other unimproved land prior to drainage.....	acres..	6,191	8,480		18,274	6,102	78,515	69,381	19,278	13,072
58	Decrease since drainage.....	acres..	3,304	2,031		3,213	4,305	40,189	52,550	7,810	7,093
59	Per cent of decrease.....		63.6	24.0		17.6	70.6	51.2	75.7	40.5	54.3
60	Swampy or subject to overflow, 1920.....	acres..	2,049	2,381	4,105	34,614	1,620	1,126	1,940	5,208	667
61	Swampy or subject to overflow prior to drainage.....	acres..	8,695	8,781	44,377	245,587	6,690	220,912	145,734	9,874	13,986
62	Decrease since drainage.....	acres..	6,646	6,400	40,272	210,973	5,070	219,786	143,794	4,666	13,319
63	Per cent of decrease.....		76.4	72.9	90.7	85.9	75.8	99.5	98.7	47.3	95.2
CAPITAL INVESTED AND COST PER ACRE.											
64	Total capital invested in and required for completion of operating enter- prises.....	dollars..	69,721	89,474	541,954	1,750,335	127,259	620,742	704,352	853,282	168,044
65	Capital invested in these enterprises to Dec. 31, 1919.....	dollars..	69,721	89,474	541,954	1,750,335	117,351	620,742	704,352	828,282	168,044
66	Additional capital required to complete these enterprises.....	dollars..					9,908			25,000	
67	Average cost per acre when completed.....	dollars..	2.89	8.71	4.90	5.70	5.59	2.48	2.15	3.45	11.48
68	Enterprises constructing open ditches only.....	dollars..	26,811	83,022	21,383	1,161,772	70,037	540,038	422,385	223,140	83,172
69	Average cost per acre when completed.....	dollars..	1.98	8.60	2.08	4.74	5.89	2.34	2.08	2.65	8.49
70	Enterprises constructing open ditches and levees.....	dollars..								30,000	
71	Average cost per acre when completed.....	dollars..								12.00	
72	Enterprises constructing tile drains only.....	dollars..	35,098		375,937	145,204	22,608	20,694	117,781	275,078	8,312
73	Average cost per acre when completed.....	dollars..	3.86		5.22	8.45	4.08	6.23	2.67	4.36	30.34
74	Enterprises constructing open ditches and tile drains.....	dollars..	7,712	5,852	144,634	449,359	34,614	60,010	164,186	325,064	76,560
75	Average cost per acre when completed.....	dollars..	4.98	10.66	5.10	9.78	6.58	3.62	2.04	3.33	16.77
76	Enterprises constructing open ditches, tile drains, and levees.....	dollars..									
77	Average cost per acre when completed.....	dollars..									
CROPS.											
78	Improved land in enterprises reporting—										
79	Corn as principal crop on drained land.....	acres..	20,680	1,239	106,442	253,624	1,509	160,157	222,671	207,043	3,045
80	Wheat as principal crop on drained land.....	acres..			164		16,902	18,524	49,959		225
81	Hay as principal crop on drained land.....	acres..						7,324	398		
82	Vegetables as principal crop on drained land.....	acres..		1,269							5,348
83	Oats as principal crop on drained land.....	acres..									
84	Other crops as principal ones on drained land.....	acres..									
85	Not reporting principal crop on drained land.....	acres..				179					3

1 Office estimate; the figures reported exceed the improved acreage in all farms in the county as determined by the census of agriculture.

2 When works under construction have been completed.

3 The figures reported have been reduced by the same acreage as the improved land, 1920.

4 Per cent not shown when more than 1,000.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Summit.	Trumbull.	Union.	Van Wert.	Wayne.	Williams.	Wood.	Wyandot.	Other counties. ¹
LAND AREA.										
1	Approximate land area of the county.....acres..	261,120	405,120	285,440	259,840	356,480	263,040	391,080	259,840	5,584,000
2	All land in operating drainage enterprises.....acres..	17,126	15,331	269,139	257,527	61,661	236,911	389,390	244,500	28,820
3	Improved land.....acres..	11,988	6,478	219,286	220,721	51,054	198,444	314,841	205,752	23,471
4	Per cent of all improved land in farms.....	8.1	3.1	98.6	98.5	19.0	95.6	99.3	97.1	0.7
5	Timber and cut-over land.....acres..	1,184	2,352	25,567	36,806	2,843	31,353	74,391	17,282	1,114
6	Other unimproved land.....acres..	3,954	6,501	24,286	7,764	7,764	7,114	158	21,466	4,235
7	Swampy or subject to overflow, in enterprises.....acres..	107	2,159	56	8,951	11,128	2,383	7,773	229	1,793
8	Suffering a loss of crops from defective drainage.....acres..	34,661	21,947	607,580	1,531,134	101,476	311,070	2,373,332	380,564	28,915
9	Assessed acreage.....	17,535	6,610	338,441	1,278,007	39,815	74,759	1,983,942	136,064	95
10	Excess over all land in operating enterprises.....acres..									
DRAINAGE WORKS.										
11	Open ditches:									
12	Completed.....miles.....	70.7	86.8	310.1	1,252.0	275.0	678.5	3,072.5	382.5	107.7
13	Additional under construction.....miles.....									
14	Maximum completed in any enterprise.....miles.....	24.9	4.6	15.0	41.6	16.9	38.4	25.3	8.1	9.0
15	Maximum width at bottom of ditch.....feet.....	35	12	20	15	40	35	40	16	70
16	Maximum of average depths of outlet ditches.....feet.....	6.0	6.0	18.0	9.8	12.0	11.0	11.0	10.0	9.0
17	Mean depth of branch ditches.....feet.....	3.8	3.4	3.1	3.6	5.2	3.3	4.5	3.5	4.6
18	Tile drains:									
19	Completed.....miles.....		4.0	587.8	209.7	6.1	179.1	81.5	254.0	10.3
20	Additional under construction.....miles.....									
21	Maximum completed in any enterprise.....miles.....		1.6	4.3	6.0	1.1	8.2	5.0	5.4	1.5
22	Maximum size of tile.....inches.....		24	28	48	18	30	42	27	22
23	Accessory levees and dikes:									
24	Completed.....miles.....			0.5						
25	Additional under construction.....miles.....									
26	Pumping plants:									
27	Engine capacity.....horsepower.....									
28	Pump capacity.....gallons per minute.....									
29	Area served by pumps.....acres.....									
30	Area drained by open ditches only.....acres.....	17,126	13,447	23,380	180,083	57,403	127,492	380,332	107,105	25,362
31	Length of these ditches.....miles.....	70.7	75.1	58.1	947.5	266.8	445.4	2,894.0	243.0	105.2
32	Average length per acre.....feet.....	21.8	20.5	13.1	27.8	24.5	18.4	40.2	12.0	21.1
33	Area having open ditches and levees.....acres.....			1,616						
34	Length of these ditches.....miles.....			0.8						
35	Average length per acre.....feet.....			2.6						
36	Length of accessory levees.....miles.....			0.5						
37	Area drained by tile only.....acres.....			79,060	28,260	420	33,634	(²)	50,568	1,826
38	Length of these tile.....miles.....			329.4	115.7	2.7	69.8	37.6	157.6	7.6
39	Average length per acre.....feet.....			22.0	21.6		11.0		16.5	22.0
40	Area drained by open ditches and tile.....acres.....		1,884	165,083	49,184	4,238	75,785	49,058	86,827	632
41	Length of these drains.....miles.....		18.6	509.6	398.5	11.6	342.4	222.4	238.3	5.2
42	Average length per acre.....feet.....		46.5	16.3	42.8	14.5	23.9		14.5	43.4
43	Area having open ditches, tile drains, and levees.....acres.....									
44	Length of these drains.....miles.....									
45	Average length per acre.....feet.....									
46	Length of accessory levees.....miles.....									
DEVELOPMENT OF LAND.										
47	Improved land in operating enterprises, 1920.....acres.....	11,988	6,478	219,286	220,721	51,054	198,444	314,841	205,752	23,471
48	Improved land prior to drainage.....acres.....	6,712	3,151	170,201	122,965	32,311	146,854	129,836	116,049	14,350
49	Increase since drainage.....acres.....	5,276	3,327	49,085	97,756	18,743	52,590	185,005	89,703	9,121
50	Per cent of increase.....	78.0	105.6	28.8	79.5	58.0	36.1	142.5	77.3	63.6
51	Per cent increase is of all improved land in farms, 1920.....	3.6	1.6	21.6	43.6	7.0	25.3	58.4	42.3	0.3
52	Timber and cut-over land, 1920.....acres.....	1,184	2,352	25,567	36,806	2,843	31,353	74,391	17,282	1,114
53	Timber and cut-over land prior to drainage.....acres.....	2,459	3,493	38,393	134,592	8,716	75,827	250,176	24,777	4,400
54	Decrease since drainage.....acres.....	1,275	1,141	12,826	97,786	5,873	44,474	181,785	7,495	3,292
55	Per cent of decrease.....	51.9	32.7	33.4	72.6	67.4	58.7	71.0	30.2	74.7
56	Other unimproved land, 1920.....acres.....	3,954	6,501	24,286	7,764	7,764	7,114	158	21,466	4,235
57	Other unimproved land prior to drainage.....acres.....	7,955	8,087	90,545	20,634	20,634	15,230	3,378	103,674	10,964
58	Decrease since drainage.....acres.....	4,001	2,186	36,259	12,870	8,116	3,220	82,208	5,829	5,829
59	Per cent of decrease.....	50.3	25.2	59.9	62.4	53.3	95.3	79.3	57.9	57.9
60	Swampy or subject to overflow, 1920.....acres.....	107	2,159	56	8,951	11,128	2,383	7,773	229	1,793
61	Swampy or subject to overflow prior to drainage.....acres.....	16,049	9,813	90,379	95,419	29,885	17,150	166,151	30,726	15,188
62	Decrease since drainage.....acres.....	15,942	7,654	90,323	86,468	18,757	14,767	158,378	30,497	13,395
63	Per cent of decrease.....	99.3	78.0	99.9	90.6	62.8	86.1	95.3	90.3	88.2
CAPITAL INVESTED AND COST PER ACRE.										
64	Total capital invested in and required for completion of operating enterprises.....dollars.....	99,888	85,196	705,535	1,544,952	319,263	512,940	1,723,397	566,244	231,243
65	Capital invested in these enterprises to Dec. 31, 1919.....dollars.....	99,888	85,196	705,535	1,544,952	319,263	512,940	1,723,397	566,244	231,243
66	Additional capital required to complete these enterprises.....dollars.....									
67	Average cost per acre when completed.....dollars.....	5.83	5.36	2.62	6.00	5.18	2.17	4.43	2.32	8.92
68	Enterprises constructing open ditches only.....dollars.....	99,888	63,467	34,312	870,038	297,896	222,318	1,571,201	148,962	219,630
69	Average cost per acre when completed.....dollars.....	5.83	4.72	1.47	4.83	5.19	1.74	4.13	1.39	8.33
70	Enterprises constructing open ditches and levees.....dollars.....			2,018						
71	Average cost per acre when completed.....dollars.....			1.25						
72	Enterprises constructing tile drains only.....dollars.....			204,331	191,335	5,748	72,492	32,276	186,217	7,865
73	Average cost per acre when completed.....dollars.....			3.34	6.77		2.16		3.68	4.31
74	Enterprises constructing open ditches and tile drains.....dollars.....		21,729	404,874	483,579	15,619	218,150	119,920	231,065	3,848
75	Average cost per acre when completed.....dollars.....		11.53	2.45	9.83	3.69	2.88		2.60	6.09
76	Enterprises constructing open ditches, tile drains, and levees.....dollars.....									
77	Average cost per acre when completed.....dollars.....									
CROPS.										
78	Improved land in enterprises reporting—									
79	Corn as principal crop on drained land.....acres.....	67	234	219,234	220,721	516	198,201	314,841	205,328	21,506
80	Wheat as principal crop on drained land.....acres.....			52		45,718	11		424	
81	Hay as principal crop on drained land.....acres.....	11,510	6,055							1,965
82	Vegetables as principal crop on drained land.....acres.....	45				4,809				
83	Onions as principal crop on drained land.....acres.....									
84	Other crops as principal ones on drained land.....acres.....		189							
85	Not reporting principal crop on drained land.....acres.....	366								

¹ Includes only Brown, Butler, Clermont, Geauga, Hamilton, Highland, Holmes, Jackson, Knox, Lawrence, Mahoning, Muskingum, Perry, Pike, Ross, Scioto, Tuscarawas, and Warren Counties.

² Office estimate; the figures reported exceed the improved acreage in all farms in the county as determined by the census of agriculture.

³ When works under construction have been completed.

⁴ Additional area reported under "open ditches only."

⁵ Area reported under "open ditches and tile."

⁶ The figures reported have been reduced by the same acreage as the improved land, 1920.

FOURTEENTH CENSUS OF THE UNITED STATES: 1920

DEPARTMENT
OF COMMERCE

BULLETIN

BUREAU OF
THE CENSUS

DRAINAGE : SOUTH CAROLINA

STATISTICS FOR THE STATE AND ITS COUNTIES

Prepared under the supervision of WILLIAM LANE AUSTIN, Chief Statistician for Agriculture, by ROGER D. MARSDEN, Special Agent in Charge of Drainage

CONTENTS.

	Page.		Page.
INTRODUCTION.....	1	DRAINAGE ENTERPRISES—Continued.	
MAP SHOWING OPERATING DRAINAGE ENTERPRISES.....	2	Size of enterprises.....	4
DRAINAGE ON FARMS.....	3	Character of enterprises.....	4
Explanation of terms.....	3	Drainage works.....	5
Farms and farm land.....	3	Maintenance of works.....	6
DRAINAGE ENTERPRISES.....	3	Date of organization.....	6
Explanation of terms.....	3	Crops.....	7
Operating and nonoperating enterprises.....	4	COUNTY TABLES:	
Location of enterprises.....	4	I.—Drainage on farms: 1920.....	7
Condition of land in enterprises.....	4	II.—Operating drainage enterprises: 1920.....	8

INTRODUCTION.

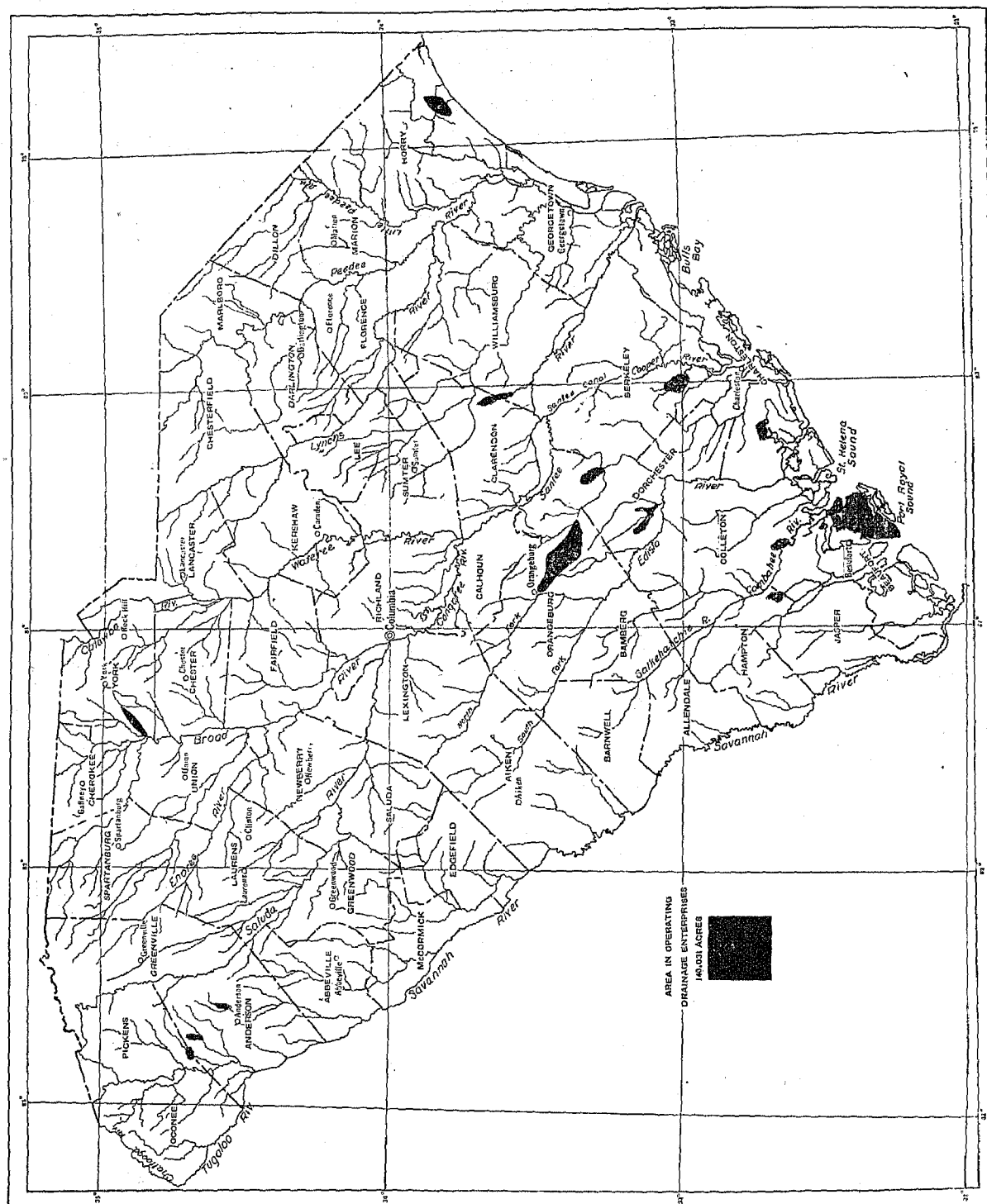
This bulletin presents the statistics of drainage for South Carolina collected at the census of 1920. The figures relate to conditions as of January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include considerable areas of unimproved land

not yet in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner constructs on his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
DRAINAGE ON FARMS.		
Number of all farms in the state.....	192, 693	100. 0
Farms reporting land having drainage.....	26, 993	14. 0
Farms reporting land needing drainage.....	24, 508	12. 7
All land in farms..... acres..	12, 426, 675	100. 0
Improved land in farms..... acres..	6, 184, 159	49. 8
Farm land reported as provided with drainage..... acres..	676, 152	5. 4
Farm land reported as needing drainage..... acres..	1, 341, 903	10. 8
DRAINAGE ENTERPRISES.		
Approximate land area of the state..... acres..	19, 516, 800	100. 0
All land in operating drainage enterprises..... acres..	140, 031	0. 7
Improved land..... acres..	59, 075	0. 3
Timber and cut-over land..... acres..	64, 955	0. 3
Other unimproved land..... acres..	16, 001	0. 1
Capital invested in and required for completion of operating enterprises..	\$936, 514	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	\$582, 183	62. 2
Additional capital required to complete these enterprises.....	\$354, 331	37. 8

SOUTH CAROLINA APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



DRAINAGE ON FARMS.

Explanation of terms.—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which are substantially as follows:

Drainage of agricultural land was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purpose of improving the condition of the soil and crops.

The area provided with drainage, in farms, is the acreage actually benefited or made of more value for agricultural purposes by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land not now suitable for crops which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators have answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual?" Levee districts, however, generally are not included in the enterprises for which data are given in this bulletin (see definition of drainage enterprises, below).

Farms and farm land.—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for growing crops by reason of the drainage. This is to be distinguished from the area merely provided with outlet facilities by organized drainage enterprises. Drainage on farms represents in most cases the result of work done by the farm owner, either independently or supplemental to the work done by a drainage enterprise, but the acreage would include also any farm land receiving similar benefits directly from the works of an enterprise. •

DRAINAGE ENTERPRISES.

Explanation of terms.—The more important terms used in connection with the census of drainage enterprises were defined as follows:

Drainage enterprises comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swamp or overflowed land for sale, other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditches or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise, though the capacities of drainage pumping plants are given only in the counties in which the plants are located.

Operating enterprises, as designated in this bulletin, are those that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

Land in drainage enterprises comprises the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises, deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (a) improved land; (b) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (c) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be considerably greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprises.

Timber and cut-over land includes farm woodland of natural or

planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, land subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering loss of crops is intended to include only land devoted to planted crops which suffer damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A pumping district is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

DRAINAGE—SOUTH CAROLINA.

Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertaking, and let contracts for the construction work, and also districts that had just been established and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. ¹		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	144,237	100.0	\$583,083	100.0	\$445,845
Operating enterprises.....	140,031	97.1	582,183	99.8	354,331
With works completed.....	24,864	17.2	198,370	34.0	.....
With works under construction..	115,167	79.8	383,813	65.8	354,331
Nonoperating enterprises.....	4,206	2.9	900	0.2	91,514

¹ The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—Most of the land in drainage enterprises in South Carolina is in the southeastern quarter of the state, though there are small areas in such enterprises in the northeastern and the northwestern parts.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	144,237	100.0	\$583,083	100.0	\$445,845
Operating enterprises.....	140,031	97.1	582,183	99.8	354,331
Santee River.....	11,007	7.6	56,937	9.8	42,726
Edisto River.....	43,816	30.4	36,219	6.2	155,000
Savannah River.....	3,408	2.4	74,651	12.8	4,505
Atlantic Ocean.....	81,800	56.7	414,376	71.1	152,100
Nonoperating enterprises.....	4,206	2.9	900	0.2	91,514
Santee River.....	1,436	1.0	300	0.1	40,000
Savannah River.....	506	0.3	600	0.1	32,400
Atlantic Ocean.....	2,270	1.6	.....	.....	19,114

Condition of land in enterprises.—The drainage enterprises in the Coastal Plain counties, comprising all

but four of the counties in which operating enterprises are located, are mostly for the purpose of reclaiming swamp land or improving level areas that generally are too wet for farming with profit. In the Piedmont section the drainage enterprises are for the protection or drainage of land subject to overflow by stream floods.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms and to afford relief from overflow for the district as a unit. Therefore the fact that an enterprise which has completed the construction of the drainage works authorized contains lands still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	140,031	100.0	24,864	115,167	4,206
Improved land.....	59,075	42.2	7,000	51,976	976
Timber and cut-over land.....	64,955	46.4	10,667	54,288	1,548
Other unimproved land.....	16,001	11.4	7,098	8,903	1,682
Swampy or subject to overflow....	18,206	13.0	704	17,502	4,106
Suffering a loss of crops.....	3,093	2.2	.....	3,093	.....

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided and the part in each county be considered a separate enterprise. In this way 17 operating drainage enterprises are counted in South Carolina, with an average area of 8,237 acres. There is no overlapping of the enterprises in this state.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

AREA ASSESSED.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	140,031	140,031	100.0
Less than 200 acres.....	40	40	.....
200 to 499 acres.....	2,198	2,198	1.6
500 to 999 acres.....	19,793	19,793	14.1
1,000 to 4,999 acres.....	20,400	20,400	14.6
5,000 to 9,999 acres.....	40,000	40,000	28.6
10,000 to 49,999 acres.....	57,000	57,000	41.1

Character of enterprises.—The drainage enterprises in South Carolina comprise districts formed in accordance with the drainage district laws of 1911 and 1912 and the sanitary and drainage district law of 1907, also undertakings by individual farm owners.

Drainage districts under the law of February 18, 1911 (act No. 54), are established by the clerk of the court of common pleas of the county in which all or a part of the proposed district is situated. A petition for establishment must be signed by a majority of the resident landowners or the owners of a major part of the land to be included. A preliminary investigation and report regarding the public utility of the undertaking are made by three viewers appointed by the clerk of the court. Public hearing is held upon the petition; then the boundaries of the district are fixed, or proceedings are dismissed at the cost of the county. The viewers prepare the plan of drainage, make awards of damages, and divide the land into five classes according to the benefits that the various tracts will receive; their report is reviewed by the clerk of the court at public hearing before it is confirmed. The cost of land taken for right of way is determined by jury trial. To secure construction of the drains and otherwise administer the affairs of the district, the clerk of the court appoints three drainage commissioners who previously have been elected by the landowners. The cost of the enterprise is assessed according to the classification of the land, the rates per acre being in the ratio 5:4:3:2:1. The district may issue bonds if the cost will exceed an average of 25 cents per acre on all the land. Originally, 22 counties were excepted from the operation of this law, but later the law was made applicable in all counties.

Each drainage district under act No. 411 of 1912 is established by a board of three disinterested drainage commissioners, who are appointed by the board of county commissioners upon receipt of a petition signed by two-thirds of the owners of land adjacent to the creek, swamp, or branch that those owners desire to open or improve for drainage. The drainage commissioners make a preliminary survey and estimate of cost for the work deemed practicable, and hold hearings upon their report. If they find the project should be undertaken, and two-thirds of the landowners sign a second petition to have the works constructed, the drainage commissioners complete the plans and specifications for the improvements, secure construction of the works, and divide the land in the district into three classes according to the anticipated drainage benefits. The cost is assessed according to the classification of the land, the rates per acre being in the ratio 5:4:3. The drainage commissioners may levy annually not exceeding \$5 per acre until the cost of drainage has been paid. By act No. 120 of 1919, bonds of the district may be issued. Land may be condemned for right of way for the drains.

Sanitary and drainage districts are organized in accordance with act No. 247 approved February 13, 1907. The governor of the state, upon request and with the advice and consent of the senator and representatives from any county, or a majority of them, shall appoint a sanitary and drainage commission for that county

with authority regarding sanitary, agricultural, and public utility drainage. The commission has control over all public drains outside of incorporated cities and towns, with power to make surveys, alterations, and improvements, to require persons to drain their land and to keep their drains in repair, and to do any and all work for drainage purposes. Each commission is required to report annually to the general assembly, and all money appropriated for the commission is required to be paid by the county treasurer from the proceeds of general county or township taxes authorized by the general assembly.

The first general drainage law of South Carolina was an act of December 20, 1856 (ch. 4307), which is still in effect, authorizing the formation of drainage corporations by two-thirds of the owners of the land to be drained, who must hold two-thirds of that acreage, signing articles of agreement to be filed in the office of the clerk of the county in which the land is situated. No enterprises were reported as organized under that law. There are also a number of other statutes providing for land drainage, each of which was made applicable in only one or a few counties, for which no enterprises were reported. A law enacted December 22, 1891, provides for securing a drainage outlet by one landowner across the property of an objecting owner, when necessary, the damages being determined by a board of referees.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	144,237	100.0	\$583,083	100.0	\$445,845
Operating enterprises.....	140,031	97.1	582,183	99.8	354,331
Drainage districts.....	57,231	39.7	155,807	26.7	202,231
Law of 1911, act No. 54.....	45,823	31.8	61,156	10.5	185,726
Law of 1912, act No. 411.....	11,408	7.9	94,651	16.2	16,505
Sanitary and drainage districts.....	57,600	39.9	10,376	1.8	5,100
Individual ownership.....	25,200	17.5	416,000	71.3	147,000
Nonoperating enterprises.....	4,206	2.9	900	0.2	91,514
Drainage districts.....	4,206	2.9	900	0.2	91,514
Law of 1911, act No. 54.....	1,436	1.0	300	0.1	40,000
Law of 1912, act No. 411.....	2,770	1.9	600	0.1	51,514

Drainage works.—The total works completed by drainage enterprises to December 31, 1919, comprised 262.7 miles of open ditches, 101.5 miles of tile drains, and 12.0 miles of accessory levees; the additional lengths under construction were 87.7 miles of ditches, 161.0 miles of tile drains, and 30.0 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. However, all the tile drains shown are in drainage enterprises under individual ownership.

DRAINAGE—SOUTH CAROLINA.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	140,031	100.0	\$582,183	100.0	\$354,331
Open ditches only.....	130,831	93.4	319,183	54.8	207,331
Open ditches, tile drains, and levees.....	9,200	6.6	263,000	45.2	147,000

There are two drainage enterprises in South Carolina in which 2,940 acres are drained by pumping part of the time. The pumping plants operate four centrifugal pumps of 44,600 gallons per minute total capacity, the plants being capable of developing 40 horsepower by steam and 115 horsepower by internal-combustion engines.

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of outlet reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 16 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet were omitted; to include this group, computed as 3 feet, would show the mean depth for the state 4.3 instead of 5.2 feet.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	140,031	100.0
Less than 3 feet.....	57,600	41.1
3.0 to 3.9 feet.....	17,800	12.7
4.0 to 4.9 feet.....	2,000	1.4
5.0 to 5.9 feet.....	9,888	6.7
6.0 to 6.9 feet.....	45,400	32.4
7.0 to 7.9 feet.....	3,007	2.1
8.0 to 8.9 feet.....	2,020	1.4
Not reported.....	2,816	2.0

Maintenance of works.—The drainage district law of 1911 provides that it shall be the duty of the board of drainage commissioners to keep the works of the district in good repair, and for this purpose they may levy an assessment against the land benefited by the construction of the improvement in the same manner and in the same proportion as the original assessment was made. The drainage district law of 1912 does

not provide for maintenance. Sanitary and drainage districts organized under the statute of 1907 are maintained by the commissioners appointed in accordance with that law, the cost of repairs being paid by taxation authorized by the general assembly the same as for original construction of improvements.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	140,031	100.0	\$582,183	100.0	\$354,331
By district forces.....	53,988	42.1	41,527	7.1	6,949
By contract.....	11,007	7.9	56,037	9.8	42,726
By landowners.....	21,016	15.0	392,219	67.4	147,000
No maintenance provided.....	2,020	1.4	43,500	7.5	2,656
Not reported.....	47,000	33.6	48,000	8.2	155,000

Date of organization.—The progress in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the districts were established by the courts, the drainage commissioners, or the governor of the state, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	140,031	100.0	140,031	100.0
1910 to 1914 ¹	18,473	13.2	18,473	13.2
1915 to 1919.....	121,558	86.8	121,558	86.8

¹ Includes 1 enterprise organized prior to 1910.

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$582,183	100.0	\$354,331
1910-1914 ¹	411,656	70.7	82,822
1915-1919.....	170,527	29.3	271,509

¹ Includes 1 enterprise organized prior to 1910.

DRAINAGE—SOUTH CAROLINA.

7

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.	350.4	100.0	262.5	100.0	42.0	100.0
1910-1914 ¹	191.0	54.5	75.0	28.6	30.0	71.4
1915-1919	159.4	45.5	187.5	71.4	12.0	28.6

¹ Includes enterprise organized prior to 1910.

Crops.—The principal crops grown upon the drained land in drainage enterprises are cotton and corn. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Abbe- ville.	Allen- dale.	Bam- berg.	Beau- fort.	Berke- ley.	Cal- houn.	Charles- ton.	Chero- kee.	
1	Number of all farms in the state or county.....	192,693	4,469	1,784	2,543	3,168	2,691	2,901	3,850	3,286	
2	Farms reporting land having drainage.....	26,993	97	255	1,035	798	505	121	1,695	40	
3	Farms reporting land needing drainage.....	24,508	274	164	997	574	759	158	1,118	457	
4	Farms in drainage and levee districts.....	1,071		81	58	176	3	82	15	2	
LAND AND FARM AREA.											
5	Approximate land area of the state or county.....acres..	19,516,800	326,400	278,400	240,000	449,280	792,320	250,240	568,320	238,720	
6	All land in farms.....acres..	12,426,675	260,265	151,187	169,929	152,350	237,572	166,172	212,539	193,005	
7	Improved land in farms.....acres..	6,184,159	145,126	97,354	105,645	66,212	67,311	98,873	85,267	99,081	
8	Woodland in farms.....acres..	5,302,575	68,257	52,835	53,531	69,468	162,845	54,182	106,662	78,676	
9	Other unimproved land in farms.....acres..	939,941	46,882	998	10,753	13,670	7,416	13,117	20,610	14,644	
10	Farm land reported as provided with drainage.....acres..	676,152	958	7,855	16,814	18,677	10,572	2,133	47,305	543	
11	Farm land reported as needing drainage.....acres..	1,341,903	6,262	8,043	26,291	44,412	50,859	10,725	79,643	12,576	
12	Drainage only.....acres..	125,548	302	1,638	746	5,586	9,397	1,326	16,361	799	
13	Drainage and clearing.....acres..	1,216,355	5,960	6,405	25,545	38,826	41,472	9,399	63,282	11,777	
		Chester- field.	Claren- don.	Colleton.	Darling- ton.	Dillon.	Dor- chester.	Fair- field.	Florence.	George- town.	
1	Number of all farms in the county.....	4,487	5,058	3,976	4,923	3,440	2,260	3,980	5,321	1,834	
2	Farms reporting land having drainage.....	775	760	1,193	1,975	960	828	63	2,465	619	
3	Farms reporting land needing drainage.....	1,355	702	1,252	701	945	499	12	1,210	567	
4	Farms in drainage and levee districts.....	6	2	5	54	2					
LAND AND FARM AREA.											
5	Approximate land area of the county.....acres..	535,680	450,560	720,640	387,200	301,440	392,320	451,840	447,360	520,020	
6	All land in farms.....acres..	319,392	235,509	401,160	277,343	177,671	205,798	342,522	300,966	227,632	
7	Improved land in farms.....acres..	148,264	145,045	141,057	167,567	103,414	71,072	167,525	146,810	38,429	
8	Woodland in farms.....acres..	164,756	85,242	231,938	94,831	68,669	125,120	133,016	147,861	150,465	
9	Other unimproved land in farms.....acres..	6,872	5,222	28,195	14,945	5,588	9,606	30,981	6,295	38,733	
10	Farm land reported as provided with drainage.....acres..	7,750	23,636	32,193	51,881	28,041	24,712	1,980	56,525	17,163	
11	Farm land reported as needing drainage.....acres..	72,663	40,066	130,119	17,707	21,900	37,617	352	47,633	85,831	
12	Drainage only.....acres..	5,369	2,125	16,661	2,453	2,024	7,440	70	4,703	6,036	
13	Drainage and clearing.....acres..	67,294	37,941	113,458	15,254	19,876	30,177	282	42,930	79,795	
		Green- ville.	Hamp- ton.	Horry.	Jasper.	Ker- shaw.	Lan- caster.	Laurens.	Lee.	Lexing- ton.	
1	Number of all farms in the county.....	6,782	2,003	4,687	1,281	3,664	3,724	6,068	4,217	4,816	
2	Farms reporting land having drainage.....	57	648	3,034	365	30	72	242	849	813	
3	Farms reporting land needing drainage.....	169	596	2,574	222	411	194	352	155	855	
4	Farms in drainage and levee districts.....		4	40		10			248	5	
LAND AND FARM AREA.											
5	Approximate land area of the county.....acres..	487,040	328,320	741,120	381,440	430,720	329,600	441,600	260,480	498,560	
6	All land in farms.....acres..	366,288	175,484	443,509	174,573	263,486	255,399	359,895	196,779	378,680	
7	Improved land in farms.....acres..	180,515	88,029	108,771	39,500	125,063	115,631	201,535	126,458	155,141	
8	Woodland in farms.....acres..	137,849	77,316	319,463	117,665	124,784	106,653	107,470	67,224	203,138	
9	Other unimproved land in farms.....acres..	41,924	10,139	15,275	17,408	12,739	33,115	50,890	3,097	15,401	
10	Farm land reported as provided with drainage.....acres..	724	27,635	66,806	28,226	2,537	847	7,197	14,944	15,669	
11	Farm land reported as needing drainage.....acres..	2,144	39,355	162,107	74,952	31,579	3,193	8,368	5,402	53,067	
12	Drainage only.....acres..	343	1,525	6,048	391	2,235	666	674	333	788	
13	Drainage and clearing.....acres..	1,801	37,830	156,059	74,561	29,344	2,527	7,694	5,069	52,279	
		Marion.	Marl- boro.	Oconee.	Orange- burg.	Rich- land.	Saluda.	Spartan- burg.	Sumter.	Williams- burg.	All other counties. ¹
1	Number of all farms in the county.....	2,579	4,477	4,183	8,558	3,889	3,917	8,260	4,897	5,904	48,796
2	Farms reporting land having drainage.....	1,357	1,400	44	1,603	325	285	312	892	348	133
3	Farms reporting land needing drainage.....	555	775	318	937	478	455	698	591	845	1,584
4	Farms in drainage and levee districts.....	2	1		23	234			7	4	7
LAND AND FARM AREA.											
5	Approximate land area of the county.....acres..	338,560	332,160	416,000	723,840	480,640	278,400	489,600	367,360	593,280	4,237,440
6	All land in farms.....acres..	100,492	214,328	267,890	496,306	277,192	245,631	408,181	265,759	340,488	3,104,773
7	Improved land in farms.....acres..	80,629	140,989	120,258	288,227	130,623	130,394	247,594	167,457	151,533	1,681,290
8	Woodland in farms.....acres..	72,881	70,141	129,836	187,248	131,624	105,200	130,812	86,194	180,082	1,037,741
9	Other unimproved land in farms.....acres..	6,982	3,198	17,796	20,831	15,045	9,037	29,775	12,108	8,873	335,772
10	Farm land reported as provided with drainage.....acres..	32,951	40,512	504	30,857	7,305	9,122	7,191	25,847	7,044	1,496
11	Farm land reported as needing drainage.....acres..	21,952	21,016	12,015	27,009	39,935	10,697	15,001	21,874	36,954	62,574
12	Drainage only.....acres..	1,323	1,489	563	9,468	2,682	447	1,880	3,004	4,713	3,940
13	Drainage and clearing.....acres..	20,629	19,527	11,452	17,541	37,253	10,250	13,121	18,870	32,241	58,634

¹ No drainage on farms reported in Chester County.

DRAINAGE—SOUTH CAROLINA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Beaufort.	Clarendon.	Orangeburg.	Other counties. ¹
LAND AREA.						
1	Approximate land area of the state or county.....acres..	10,516,800	440,280	450,560	723,840	5,792,640
2	All land in operating drainage enterprises.....acres..	140,031	57,600	4,300	42,816	35,315
3	Improved land.....acres..	50,075	34,560	344	13,408	10,763
4	Per cent of all improved land in farms.....	1.0	49.9	0.2	4.7	0.8
5	Timber and cut-over land.....acres..	64,955	17,280	3,956	28,845	14,874
6	Other unimproved land.....acres..	16,001	5,760	.....	563	9,678
7	Swampy or subject to overflow in enterprises.....acres..	18,206	5,760	.....	8,704	3,742
8	Suffering loss of crops from defective drainage.....acres..	3,093	2,304	.....	704	85
9	Assessed acreage.....	140,031	57,600	4,300	42,816	35,315
10	Excess over all land in operating enterprises.....acres..	.....	.....	.....	.....	.....
DRAINAGE WORKS.						
11	Open ditches:					
12	Completed.....miles..	262.7	20.6	2.4	13.4	226.3
13	Additional under construction.....miles..	87.7	5.1	1.6	68.6	12.4
14	Maximum completed in any enterprise.....miles..	100.0	20.6	2.4	9.4	100.6
15	Maximum width at bottom of ditch ².....feet..	28	2	18	20	28
16	Maximum of average depths of outlet ditches ².....feet..	10.0	3.0	7.0	8.0	10.0
17	Mean depth of branch ditches ².....feet..	5.2	.....	5.0	6.0	4.5
18	Tile drains:					
19	Completed.....miles..	101.5	.....	.....	.....	101.5
20	Additional under construction.....miles..	161.0	.....	.....	.....	161.0
21	Maximum completed in any enterprise.....miles..	64.0	.....	.....	.....	64.0
22	Maximum size of tile ².....inches..	24	.....	.....	.....	24
23	Accessory levees and dikes:					
24	Completed.....miles..	12.0	.....	.....	.....	12.0
25	Additional under construction.....miles..	30.0	.....	.....	.....	30.0
26	Pumping plants:					
27	Engine capacity.....horsepower..	155	.....	.....	.....	155
28	Pump capacity.....gallons per minute..	44,600	.....	.....	.....	44,600
29	Area served by pumps.....acres..	2,940	.....	.....	.....	2,940
30	Area drained by open ditches only ².....acres..	130,831	57,600	4,300	42,816	26,115
31	Length of these ditches.....miles..	235.4	25.7	4.0	82.0	123.7
32	Average length per acre.....feet..	9.5	2.4	4.9	10.1	25.0
33	Area having open ditches, tile drains, and levees ².....acres..	9,200	.....	.....	.....	9,200
34	Length of these drains.....miles..	377.5	.....	.....	.....	377.5
35	Average length per acre.....feet..	216.7	.....	.....	.....	216.7
36	Length of accessory levees.....miles..	42.0	.....	.....	.....	42.0
DEVELOPMENT OF LAND.						
37	Improved land in operating enterprises, 1920.....acres..	50,075	34,560	344	13,408	10,763
38	Improved land prior to drainage.....acres..	51,340	34,560	.....	12,845	3,044
39	Increase since drainage.....acres..	7,226	.....	344	563	6,819
40	Per cent of increase.....	15.0	.....	.....	4.4	172.9
41	Per cent increase is of all improved land in farms, 1920.....	0.1	.....	0.2	0.2	0.5
42	Timber and cut-over land, 1920.....acres..	64,955	17,280	3,956	28,845	14,874
43	Timber and cut-over land prior to drainage.....acres..	68,691	17,280	4,300	29,126	17,085
44	Decrease since drainage.....acres..	3,736	.....	344	281	3,111
45	Per cent of decrease.....	5.4	.....	8.0	1.0	17.3
46	Other unimproved land, 1920.....acres..	16,001	5,760	.....	563	9,678
47	Other unimproved land prior to drainage.....acres..	19,991	5,760	.....	845	13,386
48	Decrease since drainage.....acres..	3,990	.....	.....	282	3,708
49	Per cent of decrease.....	20.0	.....	.....	33.4	27.7
50	Swampy or subject to overflow, 1920.....acres..	18,206	5,760	.....	8,704	3,742
51	Swampy or subject to overflow prior to drainage.....acres..	91,354	57,600	3,870	9,971	19,913
52	Decrease since drainage.....acres..	73,148	51,840	3,870	1,267	16,171
53	Per cent of decrease.....	80.1	90.0	100.0	12.7	81.2
CAPITAL INVESTED AND COST PER ACRE.						
54	Total capital invested in and required for completion of operating enterprises.....dollars..	936,514	15,476	12,000	179,219	729,819
55	Capital invested in these enterprises to Dec. 31, 1919.....dollars..	582,183	10,376	4,000	24,219	543,588
56	Additional capital required to complete these enterprises.....dollars..	354,331	5,100	8,000	155,000	186,231
57	Average cost per acre when completed.....dollars..	6.69	0.27	2.79	4.19	20.67
58	Enterprises constructing open ditches only.....dollars..	526,514	15,476	12,000	179,219	319,819
59	Average cost per acre when completed.....dollars..	4.02	0.27	2.79	4.19	12.25
60	Enterprises constructing open ditches, tile drains, and levees.....dollars..	410,000	.....	.....	.....	410,000
61	Average cost per acre when completed.....dollars..	44.57	.....	.....	.....	44.57
CROPS.						
62	Improved land in enterprises reporting—					
63	Cotton as principal crop on drained land.....acres..	51,308	34,560	.....	13,408	3,340
64	Corn as principal crop on drained land.....acres..	3,035	.....	344	.....	2,691
65	Vegetables as principal crop on drained land ³.....acres..	2,352	.....	.....	.....	2,352
66	Other crops as principal ones on drained land.....acres..	2,380	.....	.....	.....	2,380

¹ Includes only Anderson, Berkeley, Charleston, Colleton, Dorchester, Hampton, Horry, Oconee, Pickens, Williamsburg, and York Counties.² When works under construction have been completed.³ Includes 1,120 acres of potatoes.

DRAINAGE : SOUTH DAKOTA

STATISTICS FOR THE STATE AND ITS COUNTIES

Prepared under the supervision of WILLIAM LANE AUSTIN, Chief Statistician for Agriculture, by ROGER D. MARSDEN, Special Agent in Charge of Drainage

CONTENTS.

	Page.		Page.
INTRODUCTION.....	1	DRAINAGE ENTERPRISES—Continued.	
MAP SHOWING OPERATING DRAINAGE ENTERPRISES.....	2	Size of enterprises.....	4
DRAINAGE ON FARMS.....	3	Character of enterprises.....	4
Explanation of terms.....	3	Drainage works.....	5
Farms and farm land.....	3	Maintenance of works.....	6
DRAINAGE ENTERPRISES.....	3	Date of organization.....	6
Explanation of terms.....	3	Crops.....	6
Operating and nonoperating enterprises.....	4	COUNTY TABLES:	
Location of enterprises.....	4	I.—Drainage on farms: 1920.....	7
Condition of land in enterprises.....	4	II.—Operating drainage enterprises: 1920.....	8

INTRODUCTION.

This bulletin presents the statistics of drainage for South Dakota collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises may include areas of unimproved land not yet in farms. The statistics

for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner constructs on his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are shown separately.

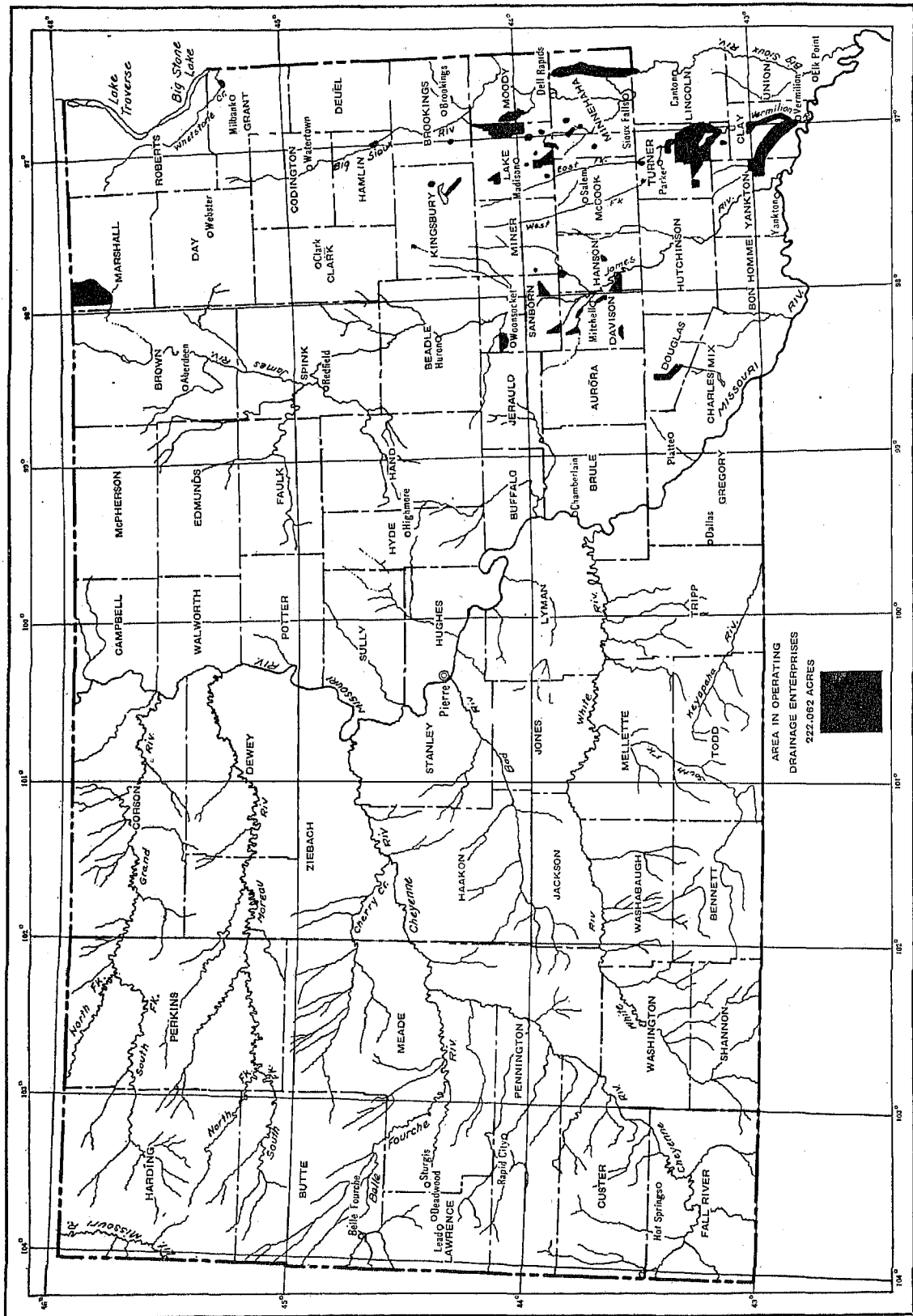
TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
DRAINAGE ON FARMS.		
Number of all farms in the state.....	74, 637	100. 0
Farms reporting land having drainage.....	4, 077	5. 5
Farms reporting land needing drainage.....	11, 828	15. 8
All land in farms..... acres..	34, 636, 491	100. 0
Improved land in farms..... acres..	18, 199, 250	52. 5
Farm land reported as provided with drainage..... acres..	161, 371	0. 5
Farm land reported as needing drainage..... acres..	446, 915	1. 3
DRAINAGE ENTERPRISES.		
Approximate land area of the state..... acres..	49, 195, 520	100. 0
All land in operating drainage enterprises..... acres..	222, 062	0. 5
Improved land..... acres..	178, 540	0. 4
Unimproved land ¹ acres..	43, 522	0. 1
Capital invested in and required for completion of operating enterprises..	\$1, 732, 729	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	\$1, 461, 063	84. 3
Additional capital required to complete these enterprises.....	\$271, 666	15. 7

¹ Only 4 acres of timber or cut-over land reported.

SOUTH DAKOTA

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



DRAINAGE ON FARMS.

Explanation of terms.—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which are substantially as follows:

Drainage of agricultural land was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purpose of improving the condition of the soil and crops.

The area provided with drainage, in farms, is the acreage actually benefited or made of more value for agricultural purposes by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land not now suitable for crops which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators have answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual." Levee districts, however, generally are not included in the enterprises for which data are given in this bulletin (see definition of drainage enterprises, below).

Farms and farm land.—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for growing crops by reason of the drainage. This is to be distinguished from the area merely provided with outlet facilities by organized drainage enterprises. Drainage on farms represents in most cases the result of work done by the farm owner, either independently or supplemental to the work done by a drainage enterprise, but the acreage would include also any farm land receiving similar benefits directly from the works of an enterprise.

DRAINAGE ENTERPRISES.

Explanation of terms.—The more important terms used in connection with the census of drainage enterprises were defined as follows:

Drainage enterprises comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swamp or overflowed land for sale, other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditches or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise, though the capacities of drainage pumping plants are given only in the counties in which the plants are located.

Operating enterprises, as designated in this bulletin, are those that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

Land in drainage enterprises comprises the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises, deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (a) improved land; (b) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (c) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be considerably greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprises.

Timber and cut-over land includes farm woodland of natural or

planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, land subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering loss of crops is intended to include only land devoted to planted crops which suffer damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A pumping district is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

DRAINAGE ON FARMS.

Explanation of terms.—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which are substantially as follows:

Drainage of agricultural land was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purpose of improving the condition of the soil and crops.

The area provided with drainage, in farms, is the acreage actually benefited or made of more value for agricultural purposes by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land not now suitable for crops which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators have answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual." Levee districts, however, generally are not included in the enterprises for which data are given in this bulletin (see definition of drainage enterprises, below).

Farms and farm land.—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for growing crops by reason of the drainage. This is to be distinguished from the area merely provided with outlet facilities by organized drainage enterprises. Drainage on farms represents in most cases the result of work done by the farm owner, either independently or supplemental to the work done by a drainage enterprise, but the acreage would include also any farm land receiving similar benefits directly from the works of an enterprise.

DRAINAGE ENTERPRISES.

Explanation of terms.—The more important terms used in connection with the census of drainage enterprises were defined as follows:

Drainage enterprises comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swamp or overflowed land for sale, other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditches or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise, though the capacities of drainage pumping plants are given only in the counties in which the plants are located.

Operating enterprises, as designated in this bulletin, are those that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

Land in drainage enterprises comprises the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises, deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (a) improved land; (b) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (c) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be considerably greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprises.

Timber and cut-over land includes farm woodland of natural or

planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, land subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering loss of crops is intended to include only land devoted to planted crops which suffer damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A pumping district is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

Operating and nonoperating enterprises.—In the tables that follow, statistics are given for operating enterprises only, as no nonoperating drainage enterprises were found in South Dakota. The operating enterprises, as already defined, include both those that have completed their drainage works and those with such works under construction; among the latter might be any that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN WORKS COMPLETED AND WORKS UNDER CONSTRUCTION: 1920.

CLASS.	LAND.		CAPITAL. ¹		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises ²	222,062	100.0	\$1,461,063	100.0	\$271,606
With works completed.....	124,132	55.9	912,757	61.5	.....
With works under construction.....	97,930	44.1	518,306	35.5	271,606

¹ The inquiry asked for the "total cost of the enterprise to Dec. 31, 1919," and for an "estimate of additional investment to complete."

² No nonoperating enterprises in South Dakota.

Location of enterprises.—All the enterprises in South Dakota are situated east of Missouri River, and most of them are in the southeastern part of the state. Nearly all the land in the enterprises is drained through tributaries of the Missouri.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises ¹	222,062	100.0	\$1,461,063	100.0	\$271,606
Missouri River.....	162,480	73.2	800,709	54.8	78,906
Big Sioux River.....	59,078	26.6	656,961	45.0	192,760
Minnesota River.....	495	0.2	3,393	0.2	.....

¹ No nonoperating enterprises in South Dakota.

Condition of land in enterprises.—The drainage enterprises in this state generally are reported to have been organized for the improvement of agricultural land that was wet, swampy, or subject to overflow, though a major part of the acreage included in the enterprises was unimproved before drainage was provided. Only 640 acres were reported as timbered or cut-over before drainage, and only 4 acres as timbered on January 1, 1920.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms, and

to afford relief from overflow for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains lands still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES. ¹			
	Total.		Works completed (acres).	Works under construction (acres).
	Acreage.	Per cent of all land.		
All land in enterprises.....	222,062	100.0	124,132	97,930
Improved land.....	178,540	80.4	110,374	68,166
Unimproved land ²	43,522	19.6	13,758	29,764
Swampy or subject to overflow.....	6,067	2.7	3,801	2,266
Suffering a loss of crops.....	481	0.2	481	.....

¹ No nonoperating enterprises in South Dakota.

² Only 4 acres of timber or cut-over land reported.

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way, 90 drainage enterprises are counted in South Dakota, with an average area of 2,602 acres assessed. The assessed acreage exceeds the land in enterprises by 12,139 acres, which is the amount of overlapping. The land in enterprises and the assessed acreage on each line of Table 5 refer to the same enterprises. From the total area of each enterprise, designated as the assessed acreage, deduction was made for the amount of overlapping with enterprises organized previously, to determine the acreage to be tabulated as land in enterprises.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

AREA ASSESSED.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	222,062	234,201	100.0
Less than 200 acres.....	519	519	0.2
200 to 499 acres.....	10,027	10,027	4.3
500 to 999 acres.....	13,495	13,495	5.8
1,000 to 4,999 acres.....	56,007	68,146	29.1
5,000 to 9,999 acres.....	17,788	17,788	7.6
10,000 acres and over.....	124,226	124,226	53.0

Character of enterprises.—All the drainage enterprises in this state are county drains organized under the drainage law of March 7, 1905 (ch. 98), or that of February 21, 1907 (ch. 134). The later act did not specifically repeal the earlier one, but the principal provisions of the two are nearly identical. The state constitution declares that the drainage of agricultural land is a public purpose (art. 21, sec. 6, adopted 1906).

The county drains are established by the board of county commissioners upon petition from one or more owners of land that will be affected, if the proposed drainage will be of public benefit or necessary for draining agricultural land. The county commissioners inspect the route of the proposed improvement, and may have a survey made and determine the location of the drain. Public hearing upon the petition is held by the commissioners, who then dismiss the petition or establish the drain and fix the damages to be paid for any injury to land or property that will be caused by the work. The cost of the drainage is paid by the land, railroads, towns, and townships in proportion to the benefits to be received as determined by the county commissioners. Appeals from the determination of the commissioners may be taken to the circuit court of the county. Construction of the drain is secured by the commissioners, who may issue bonds payable in not more than 20 years from the special assessments against the property benefited. An act of February 26, 1909 (ch. 102), requires that the county commissioners make their examination of the route of a proposed drain in company with the state engineer, who shall have supervision of the survey and of the design and construction of the works.

Drains in two or more counties are under the jurisdiction of the board of commissioners of the county containing the greatest part of drainage area, if not more than one county contains as much as 3,000 acres of that area, according to an act of March 10, 1917 (ch. 208). When two or more counties each embrace more than 3,000 acres of land to be affected by the same drain, the boards of commissioners of all those counties have joint jurisdiction. Before 1917, for drains in more than one county the petition must have been signed by owners of land in each county affected, and the boards of commissioners of those counties acted jointly.

Drains to be established by mutual agreement are authorized by the laws of both 1905 and 1907. The owners of the land to be drained may file with the county auditor a written agreement, duly acknowledged, stating the location for the drain and the apportionment of damages and benefits. The county commissioners then will have the drain constructed in accordance with the agreement if they deem the enterprise will be of advantage to the landowners.

The formation of drainage districts in South Dakota to secure cooperation with similar districts in neighboring states, when such cooperation is desired in obtaining drainage and protection against floods, is authorized by a statute of February 24, 1917 (ch. 209). The districts are to be established by the circuit court of the county, upon petition from 50 or more residents and freeholders in the territory to be embraced in the district, or from the county

commissioners. A board of three members to govern the district is appointed by the commissioners. Provision is made for a district situated in two or more counties. No enterprises were reported as organized under this law.

Laws authorizing the establishment of public drains by the boards of county commissioners and by the boards of township supervisors, upon petition from one or more landowners, were enacted by the legislature of Dakota territory in 1883. Viewers were appointed to assess damages and benefits, the cost being apportioned according to the benefits. The South Dakota statute of March 10, 1897 (ch. 76), enacted a new law similar in its main provisions to the territorial drainage laws, which were repealed. No enterprises were reported under any of these statutes.

TABLE 6.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY CHARACTER OF ENTERPRISE: 1920.

CHARACTER OF ENTERPRISE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises ¹	222,062	100.0	\$1,461,063	100.0	\$271,666
County drains.....	222,062	100.0	1,461,063	100.0	271,666
Laws of 1905, ch. 98.....	56,790	25.6	265,113	18.1	
Laws of 1907, ch. 134.....	165,266	74.4	1,195,950	81.9	271,666

¹ No nonoperating enterprises in South Dakota.

Drainage works.—The total works completed by the drainage enterprises to December 31, 1919, comprised 237.8 miles of open ditches, 179.3 miles of tile drains, and 2.4 miles of accessory levees; the additional lengths under construction were 8.1 miles of open ditches and 33.6 miles of tile drains. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There are no pumping districts for land drainage in South Dakota.

TABLE 7.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	222,062	100.0	\$1,461,063	100.0	\$271,666
Open ditches only.....	145,834	65.7	822,864	56.3	68,906
Open ditches and levees.....	4,120	1.9	9,447	0.6	
Tile drains only.....	30,764	13.9	312,803	21.4	47,460
Open ditches and tile drains.....	40,664	18.3	313,239	21.4	155,300
Open ditches, tile drains, and levees.....	680	0.3	2,710	0.2	

The average depth of the main or outlet ditch was reported for each enterprise. The maximum reported for any enterprise in the state and the maximum in each county are shown in line 14 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

In County Table II, line 15 shows the mean depth of branch ditches (open ditches only), which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations.

TABLE 8.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	222,062	100.0
3.0 to 3.9 feet.....	23,035	10.4
4.0 to 4.9 feet.....	18,995	8.6
5.0 to 5.9 feet.....	47,520	21.4
6.0 to 6.9 feet.....	1,500	0.7
7.0 to 7.9 feet.....	131,012	59.0
Not reporting branches.....		

Maintenance of works.—The drainage laws of 1905 and 1907 provide that assessments for maintenance of the drainage works may be made by the county commissioners upon petition from an interested landowner, to be apportioned in the same manner as the assessments for construction. The later statute provides also that all drains constructed under any law of the state, except as otherwise may be provided, shall be under control of the county commissioners who must keep the drains in good repair. Each part of a drain situated in more than one county is under the charge of the commissioners of the county in which the part is located. The works of drainage districts under the statute of 1917 are to be maintained by joint agreement in the same manner as prescribed for construction, but in the absence of such agreement are to be maintained like county drains under the law of 1907.

TABLE 9.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1910.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	222,062	100.0	\$1,461,063	100.0	\$271,666
By district forces.....	56,159	25.3	589,824	40.4	192,760
By contract.....	5,663	2.6	60,685	4.2	
No maintenance provided.....	160,240	72.2	810,554	55.5	78,906

Date of organization.—The progress of development in drainage is shown only roughly by the dates of the organization of the enterprises, which are the dates when the drains were established by the county commissioners, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large enterprise. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including any extensions made after the original plan of reclamation was completed.

TABLE 10.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	222,062	100.0	234,201	100.0
1905 to 1909.....	59,446	26.8	59,446	25.4
1910 to 1914.....	40,866	18.2	52,504	22.4
1915 to 1919.....	122,251	55.1	122,251	52.2

TABLE 11.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	CAPITAL.		
	To Dec. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$1,461,063	100.0	\$271,666
1905 to 1909.....	230,876	15.8	
1910 to 1914.....	454,928	31.1	35,000
1915 to 1919.....	775,259	53.1	236,666

TABLE 12.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	245.9	100.0	212.9	100.0	2.4	100.0
1905 to 1909.....	79.4	32.3	16.0	7.5	1.8	75.0
1910 to 1914.....	103.4	42.0	29.8	14.0	0.6	25.0
1915 to 1919.....	63.1	25.7	167.1	78.5		

Crops.—The principal crops grown upon the drained land in drainage enterprises are corn and wheat. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified in County Table II. No data were secured at the general census of agriculture to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE—SOUTH DAKOTA.

7

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		THE STATE.	Beadle.	Bon Homme.	Brook- ings.	Butte.	Clark.	Clay.	Davison.	
1	Number of all farms in the state or county.....	74,637	1,716	1,394	1,891	1,005	1,519	1,237	981	
2	Farms reporting land having drainage.....	4,077	12	84	114	16	31	187	98	
3	Farms reporting land needing drainage.....	11,828	330	305	416	78	435	106	279	
4	Farms in drainage and levee districts.....	1,028	3	5	14	12	8	20	8	
LAND AND FARM AREA.										
5	Approximate land area of the state or county.....acres..	49,195,520	800,000	368,720	506,240	1,464,960	623,360	257,920	276,480	
6	All land in farms.....acres..	34,636,491	705,066	353,250	472,237	722,033	521,769	236,428	261,137	
7	Improved land in farms.....acres..	18,199,250	529,398	271,598	415,125	88,967	453,557	219,839	212,470	
8	Woodland in farms.....acres..	536,183	3,831	7,059	6,041	32,737	3,839	5,881	3,282	
9	Other unimproved land in farms.....acres..	15,901,058	171,837	74,593	51,071	600,929	64,873	10,708	45,385	
10	Farm land reported as provided with drainage.....acres..	161,371	577	2,980	3,296	526	560	14,100	4,771	
11	Farm land reported as needing drainage.....acres..	446,915	15,595	5,187	13,859	1,712	16,970	7,412	10,629	
12	Drainage only.....acres..	356,049	15,375	4,704	12,404	1,664	15,762	7,412	9,403	
13	Drainage and clearing.....acres..	90,866	220	393	1,455	48	1,218	-----	1,226	
		Day.	Deuel.	Douglas.	Grant.	Hamlin.	Hanson.	Hutchin- son.	Jones.	Kings- bury.
1	Number of all farms in the county.....	1,995	1,160	912	1,347	1,054	879	1,553	484	1,597
2	Farms reporting land having drainage.....	205	184	42	151	64	175	162	1	205
3	Farms reporting land needing drainage.....	759	417	239	276	102	411	374	2	490
4	Farms in drainage and levee districts.....	18	26	30	36	26	101	22	-----	44
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	679,040	404,480	278,400	442,240	332,800	276,480	522,880	628,480	520,960
6	All land in farms.....acres..	632,055	343,731	254,178	384,687	308,724	254,745	501,336	499,456	487,685
7	Improved land in farms.....acres..	506,462	284,402	182,129	302,064	270,836	206,080	402,399	177,884	459,258
8	Woodland in farms.....acres..	9,819	3,245	4,000	5,303	1,927	2,591	5,486	13,832	7,089
9	Other unimproved land in farms.....acres..	115,774	56,084	68,049	77,320	30,961	46,074	93,451	307,740	30,338
10	Farm land reported as provided with drainage.....acres..	3,577	7,801	1,198	4,505	3,887	7,836	8,252	1,750	5,910
11	Farm land reported as needing drainage.....acres..	24,700	12,280	5,523	5,616	4,783	15,973	8,626	140	11,127
12	Drainage only.....acres..	23,636	12,050	5,404	5,121	4,705	15,432	8,306	-----	10,779
13	Drainage and clearing.....acres..	1,154	230	119	495	78	541	320	140	343
		Lake.	Lincoln.	McCook.	Marshall.	Moade.	Miner.	Minne- haha.	Moody.	Roberts.
1	Number of all farms in the county.....	1,285	1,755	1,253	1,269	1,722	1,153	2,294	1,245	2,194
2	Farms reporting land having drainage.....	314	188	167	96	3	51	287	145	117
3	Farms reporting land needing drainage.....	644	280	402	368	52	320	555	331	604
4	Farms in drainage and levee districts.....	103	114	15	54	6	2	79	17	30
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	359,680	367,360	366,720	568,960	2,234,240	363,520	521,600	337,280	711,040
6	All land in farms.....acres..	332,597	355,027	321,706	495,059	1,850,497	337,128	488,764	306,761	617,408
7	Improved land in farms.....acres..	291,323	329,700	277,539	415,035	202,502	267,596	431,239	257,003	508,795
8	Woodland in farms.....acres..	3,545	5,816	2,951	20,880	20,547	2,994	9,262	7,727	5,370
9	Other unimproved land in farms.....acres..	37,720	19,451	41,306	59,144	1,157,388	66,535	48,263	42,031	103,243
10	Farm land reported as provided with drainage.....acres..	8,500	8,559	2,868	6,738	580	1,026	7,599	6,186	4,544
11	Farm land reported as needing drainage.....acres..	18,200	10,306	11,362	20,874	5,771	8,902	14,914	11,441	19,562
12	Drainage only.....acres..	17,437	9,800	10,212	8,704	130	8,843	13,001	10,609	16,764
13	Drainage and clearing.....acres..	763	506	1,150	12,110	5,641	149	1,913	832	2,798
		Sanborn.	Spink.	Tripp.	Turner.	Union.	Wal- worth.	Yankton.	All other counties. ¹	
1	Number of all farms in the county.....	1,021	1,874	1,856	1,862	1,421	653	1,520	29,536	
2	Farms reporting land having drainage.....	92	25	7	482	79	1	213	89	
3	Farms reporting land needing drainage.....	693	78	38	661	280	123	191	1,130	
4	Farms in drainage and levee districts.....	20	19	-----	184	5	-----	8	4	
LAND AND FARM AREA.										
5	Approximate land area of the county.....acres..	368,640	967,040	1,042,560	394,880	289,280	474,880	334,720	31,111,680	
6	All land in farms.....acres..	327,638	864,006	776,007	382,292	240,883	371,791	314,306	19,781,414	
7	Improved land in farms.....acres..	239,905	794,095	388,260	334,230	229,572	222,118	235,707	7,807,643	
8	Woodland in farms.....acres..	2,282	7,211	6,385	4,748	7,447	6,710	8,164	298,682	
9	Other unimproved land in farms.....acres..	91,451	62,700	381,962	43,314	12,864	142,968	70,435	11,675,089	
10	Farm land reported as provided with drainage.....acres..	5,627	2,631	690	20,094	2,640	540	6,959	3,104	
11	Farm land reported as needing drainage.....acres..	40,209	2,329	2,194	16,300	10,981	14,353	7,405	71,500	
12	Drainage only.....acres..	36,350	2,066	2,194	15,143	6,462	958	5,008	41,071	
13	Drainage and clearing.....acres..	4,859	263	-----	1,157	4,519	13,395	2,397	30,429	

¹ No drainage on farms reported in Armstrong, Brown, Buffalo, Campbell, Corson, Edmunds, Gregory, Haakon, Harding, Hughes, Hyde, Jackson, Lyman, McPherson, Mollote, Perkins, Shannon, Stanley, Sully, Todd, Washabaugh, and Ziebach Counties.

DRAINAGE—SOUTH DAKOTA.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Brookings.	Clay.	Davison.	Douglas.	Hanson.	Kings- bury.	Lake.
LAND AREA.									
1	Approximate land area of the state or county.....acres.	49,105,520	506,240	257,920	276,480	278,400	276,480	520,060	359,680
2	All land in operating drainage enterprises.....acres.	222,062	1,200	39,829	6,138	7,120	3,640	1,930	28,240
3	Improved land.....acres.	178,540	1,080	38,829	5,463	4,984	3,071	1,778	22,451
4	Per cent of all improved land in farms.....	1.0	0.3	17.7	2.6	2.7	1.5	0.4	7.7
5	Unimproved land.....acres.	143,522	120	1,000	675	2,136	569	152	5,789
6	Swampy or subject to overflow, in enterprises.....acres.	6,067	120	136	125	35	32	45	1,060
7	Suffering loss of crops from defective drainage.....acres.	481			40	25	42		
8	Assessed acreage.....acres.	234,201	1,200	51,968	6,138	7,120	3,640	1,930	28,240
9	Excess over all land in operating enterprises.....acres.	12,139		12,139					
DRAINAGE WORKS.									
10	Open ditches:								
11	Completed.....miles.	237.8	4.3	37.0	22.8	11.5	0.8	32.1	9.5
12	Additional under construction.....miles.	8.1							
13	Maximum completed in any enterprise.....miles.	28.6	4.3	10.5	10.7	6.5	0.8	28.6	5.5
14	Maximum width at bottom of ditch ².....feet.	100	2	75	6	5	2	10	10
15	Maximum of average depths of outlet ditches ².....feet.	10.5	6.6	10.5	0.0	5.0	1.8	9.0	8.5
16	Mean depth of branch ditches ².....feet.	4.8				3.0		6.1	4.0
17	Tile drains:								
18	Completed.....miles.	179.3			19.0	0.2	7.6	3.0	82.8
19	Additional under construction.....miles.	33.6							20.7
20	Maximum completed in any enterprise.....miles.	25.9			12.1	0.2	5.5	3.0	25.9
21	Maximum size of tile ².....inches.	36			28	20	24	24	36
22	Accessory levees and dikes:								
23	Completed.....miles.	2.4							
24	Additional under construction.....miles.								
25	Area drained by open ditches only ².....acres.	3,149,954	1,200	39,829	3,223	3,520		430	
26	Length of these ditches.....miles.	177.2	4.3	37.0	17.2	6.5		3.5	
27	Average length per acre.....feet.	6.2	18.9	4.9	28.2	9.8		43.0	
28	Area drained by tile only ².....acres.	30,764			2,155		1,340		9,080
29	Length of these tile.....miles.	116.0			6.9		2.1		47.1
30	Average length per acre.....feet.	19.9			16.9		8.3		27.5
31	Area drained by open ditches and tile ².....acres.	4,41,344			760	3,600	2,300	1,500	19,210
32	Length of these drains.....miles.	165.6			17.7	5.2	6.3	31.6	65.9
33	Average length per acre.....feet.	21.1			123.0	7.0	14.5	111.2	18.1
DEVELOPMENT OF LAND.									
34	Improved land in operating enterprises, 1920.....acres.	178,540	1,080	38,829	5,463	4,984	3,071	1,778	22,451
35	Improved land prior to drainage.....acres.	98,724		3,304		3,912	1,616	825	10,604
36	Increase since drainage.....acres.	79,816	1,080	35,525	5,463	1,072	1,455	953	2,757
37	Per cent of increase ³	80.8				27.4	90.0	115.5	14.0
38	Per cent increase is of all improved land in farms, 1920.....	0.4	0.3	16.2	2.6	0.6	0.7	0.2	0.9
39	Unimproved land, 1920.....acres.	143,522	120	1,000	675	2,136	569	152	5,789
40	Unimproved land prior to drainage.....acres.	123,338	1,200	36,525	6,138	3,208	2,024	1,105	8,546
41	Decrease since drainage.....acres.	79,816	1,080	35,525	5,463	1,072	1,455	953	2,757
42	Per cent of decrease.....	64.7	90.0	97.3	89.0	33.4	71.9	86.2	32.3
43	Swampy or subject to overflow, 1920.....acres.	6,067	120	136	125	35	32	45	1,060
44	Swampy or subject to overflow prior to drainage.....acres.	141,491	600	34,194	6,138	1,248	932	1,190	21,390
45	Decrease since drainage.....acres.	135,424	480	34,058	6,013	1,213	920	1,145	19,724
46	Per cent of decrease.....	95.7	80.0	99.6	98.0	97.2	96.6	96.2	92.2
CAPITAL INVESTED AND COST PER ACRE.									
47	Total capital invested in and required for completion of operating enterprises.....dollars.	1,732,729	1,776	333,136	66,420	24,000	27,000	67,058	363,832
48	Capital invested in these enterprises to Dec. 31, 1919.....dollars.	1,461,063	1,776	333,136	66,420	24,000	27,000	67,058	246,072
49	Additional capital required to complete these enterprises.....dollars.	271,666							117,760
50	Average cost per acre when completed.....dollars.	7.80	1.48	8.36	10.82	3.37	7.42	34.75	12.88
51	Enterprises constructing open ditches only.....dollars.	690,217	1,776	333,136	35,913	13,000		3,550	
52	Average cost per acre when completed.....dollars.	6.01	1.48	8.36	11.14	3.69		8.26	
53	Enterprises constructing tile drains only.....dollars.	360,263			19,230		7,000		130,345
54	Average cost per acre when completed.....dollars.	11.71			8.92		5.22		14.43
55	Enterprises constructing open ditches and tile drains.....dollars.	747,149			11,277	11,000	20,000	63,508	233,487
56	Average cost per acre when completed.....dollars.	11.40			14.84	3.06	8.70	42.34	12.15
CROPS.									
57	Improved land in enterprises reporting—								
58	Corn as principal crop on drained land.....acres.	148,804	1,080	38,829	5,463	4,984	3,039		22,451
59	Wheat as principal crop on drained land.....acres.	27,926							
60	Barley as principal crop on drained land.....acres.	1,810					32	1,778	

¹ Only 4 acres of timber or cut-over land reported for 1920, and 640 acres prior to drainage.

² When works under construction have been completed.

³ Includes 1 enterprise constructing also 1.8 miles of levee.

⁴ Includes 1 enterprise constructing also 0.6 mile of levee.

⁵ Per cent not shown when more than 1,000.

⁶ Includes cost of 1.8 miles of levee.

⁷ Includes cost of 0.6 miles of levee.

DRAINAGE—SOUTH DAKOTA.

9

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Marshall.	Minne- haha.	Moody.	Sanborn.	Spink.	Turner.	Yankton.	Other counties. ¹	
LAND AREA.										
1	Approximate land area of the county.....	acres.....	568,960	521,600	337,280	368,640	967,040	394,880	334,720	1,587,200
2	All land in operating drainage enterprises.....	acres.....	47,520	21,444	6,000	9,700	3,197	32,270	12,085	1,749
3	Improved land.....	acres.....	23,760	20,083	5,400	9,700	3,101	25,347	12,085	1,408
4	Per cent of all improved land in farms.....		5.7	4.7	2.1	4.1	0.4	7.6	5.1	0.1
5	Unimproved land.....	acres.....	23,760	1,361	600		96	6,923		341
6	Swampy or subject to overflow, in enterprises.....	acres.....		81	600			2,729		498
7	Suffering loss of crops from defective drainage.....	acres.....					53			321
8	Assessed acreage.....		47,520	21,444	6,000	9,700	3,197	32,270	12,085	1,749
9	Excess over all land in operating enterprises.....	acres.....								
DRAINAGE WORKS.										
10	Open ditches:									
11	Completed.....	miles.....	15.8	14.6	4.0		10.5	60.5	6.7	7.7
12	Additional under construction.....	miles.....	6.7	1.4						
13	Maximum completed in any enterprise.....	miles.....	15.8	14.6	4.0		10.5	8.3	8.5	3.4
14	Maximum width at bottom of ditch.....	feet.....	24	100	10		15	18	30	12
15	Maximum of average depths of outlet ditches.....	feet.....	6.5	9.0	8.5		6.0	7.0	10.5	5.0
16	Mean depth of branch ditches.....	feet.....	6.0		4.0			3.0	3.0	4.0
17	Tile drains:									
18	Completed.....	miles.....		14.9	8.6	11.3		26.2		5.7
19	Additional under construction.....	miles.....			3.2	9.7				
20	Maximum completed in any enterprise.....	miles.....		4.3	8.8	7.0		3.8		2.9
21	Maximum size of tile.....	inches.....		20	30	22		24		24
22	Accessory levees and dikes:									
23	Completed.....	miles.....					2.4			
24	Additional under construction.....	miles.....								
25	Area drained by open ditches only.....	acres.....	47,520	20,000			3,197	18,950	12,085	
26	Length of these ditches.....	miles.....	22.5	16.0			10.5	53.0	6.7	
27	Average length per acre.....	feet.....	2.5	4.2			17.3	14.8	2.9	
28	Area drained by tile only.....	acres.....		1,444		9,700		6,800		495
29	Length of these tile.....	miles.....		14.9		21.0		20.0		4.0
30	Average length per acre.....	feet.....		54.5		11.4		16.0		42.7
31	Area drained by open ditches and tile.....	acres.....			6,000			6,720		1,254
32	Length of these drains.....	miles.....			15.8			13.7		9.4
33	Average length per acre.....	feet.....			13.9			10.8		39.6
DEVELOPMENT OF LAND.										
34	Improved land in operating enterprises, 1920.....	acres.....	23,760	20,083	5,400	9,700	3,101	25,347	12,085	1,408
35	Improved land prior to drainage.....	acres.....	23,760	18,599	4,500	4,484		17,710		353
36	Increase since drainage.....	acres.....		1,517	900	5,216	3,101	7,637	12,085	1,055
37	Per cent of increase.....			8.2	20.0	118.3		43.1		298.9
38	Per cent increase is of all improved land in farms, 1920.....			0.4	0.4	2.2	0.4	2.3	5.1	0.1
39	Unimproved land, 1920.....	acres.....	23,760	1,361	600		96	6,923		341
40	Unimproved land prior to drainage.....	acres.....	23,760	2,873	1,600	5,216	3,197	14,560	12,085	1,396
41	Decrease since drainage.....	acres.....		1,517	900	5,216	3,101	7,637	12,085	1,055
42	Per cent of decrease.....			52.7	60.0	100.0	97.0	52.5	100.0	75.6
43	Swampy or subject to overflow, 1920.....	acres.....		81	600			2,729		498
44	Swampy or subject to overflow prior to drainage.....	acres.....	14,256	18,588	5,100	1,690	3,197	19,839	11,973	1,136
45	Decrease since drainage.....	acres.....	14,256	18,507	4,500	1,690	3,197	17,110	11,973	638
46	Per cent of decrease.....		100.0	99.6	88.2	100.0	100.0	86.2	100.0	56.2
CAPITAL INVESTED AND COST PER ACRE.										
47	Total capital invested in and required for completion of operating enterprises.....	dollars.....	96,906	326,436	96,581	85,000	13,028	162,774	57,000	21,782
48	Capital invested in these enterprises to Dec. 31, 1919.....	dollars.....	53,000	301,436	96,581	50,000	13,028	162,774	57,000	21,782
49	Additional capital required to complete these enterprises.....	dollars.....	43,906	25,000	50,000	35,000				
50	Average cost per acre when completed.....	dollars.....	2.04	15.22	14.43	8.76	4.08	5.04	4.72	12.45
51	Enterprises constructing open ditches only.....	dollars.....	96,906	280,000			13,028	66,908	57,000	
52	Average cost per acre when completed.....	dollars.....	2.04	14.00			4.08	3.53	4.72	
53	Enterprises constructing tile drains only.....	dollars.....		46,436		85,000		63,831		8,421
54	Average cost per acre when completed.....	dollars.....		32.16		8.76		9.67		17.01
55	Enterprises constructing open ditches and tile drains.....	dollars.....			86,581			32,035		13,361
56	Average cost per acre when completed.....	dollars.....			14.43			4.77		10.65
CROPS.										
57	Improved land in enterprises reporting—									
58	Corn as principal crop on drained land.....	acres.....		20,083	5,400	9,700		25,347	12,085	343
59	Wheat as principal crop on drained land.....	acres.....	23,760				3,101			1,065
60	Barley as principal crop on drained land.....	acres.....								

¹ Includes only Codington, Grant, Hamlin, and Miner Counties.² When works under construction have been completed.³ Includes one enterprise constructing also 1.8 miles of levee.⁴ Includes one enterprise constructing also 0.6 mile of levee.⁵ Per cent not shown when more than 1,000.⁶ Includes cost of 1.8 miles of levee.⁷ Includes cost of 0.6 mile of levee.

DRAINAGE : TENNESSEE

STATISTICS FOR THE STATE AND ITS COUNTIES

Prepared under the supervision of WILLIAM LANE AUSTIN, Chief Statistician for Agriculture, by ROGER D. MARSDEN, Special Agent in Charge of Drainage

CONTENTS.

	Page.		Page.
INTRODUCTION.....	1	DRAINAGE ENTERPRISES—Continued.	
MAP SHOWING OPERATING DRAINAGE ENTERPRISES.....	2	Size of enterprises.....	4
DRAINAGE ON FARMS.....	3	Character of enterprises.....	5
Explanation of terms.....	3	Drainage works.....	5
Farms and farm land.....	3	Maintenance of works.....	6
DRAINAGE ENTERPRISES.....	3	Date of organization.....	6
Explanation of terms.....	3	Crops.....	6
Operating and nonoperating enterprises.....	4	COUNTY TABLES:	
Location of enterprises.....	4	I.—Drainage on farms.....	7
Condition of land in enterprises.....	4	II.—Operating drainage enterprises.....	8-9

INTRODUCTION.

This bulletin presents the statistics of drainage for Tennessee collected at the census of 1920. The figures relate to conditions on January 1, 1920, except where indicated otherwise. No census of drainage has been taken heretofore, so there are no comparable figures for previous years. The data relate to the artificial drainage of land in farms, and of other land that ultimately will be used for agricultural purposes. The organized drainage enterprises include considerable areas of timbered and other unimproved land not yet

in farms. The statistics for drainage on farms were collected in the general census of agriculture, while the statistics for drainage enterprises were obtained in a special canvass of those enterprises. Since drainage on farms may be either inside or outside an organized enterprise, and the drains that each individual owner installs upon his own farm may be either supplemental to or entirely independent of the works installed by an enterprise, the figures for the two parts of the drainage census are presented separately.

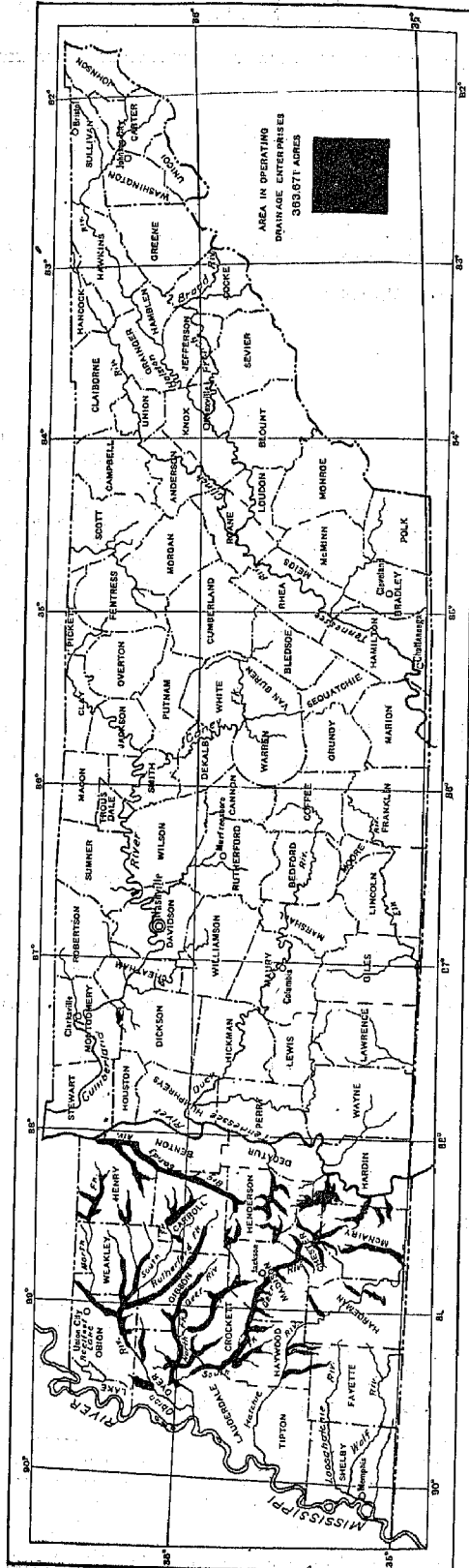
TABLE 1.—SUMMARY FOR THE STATE: 1920.

ITEM.	Amount.	Per cent of total.
DRAINAGE ON FARMS.		
Number of all farms in the state.....	252, 774	100. 0
Farms reporting land having drainage.....	8, 887	3. 5
Farms reporting land needing drainage.....	20, 997	8. 3
All land in farms..... acres..	19, 510, 856	100. 0
Improved land in farms..... acres..	11, 185, 302	57. 3
Farm land reported as provided with drainage..... acres..	254, 118	1. 3
Farm land reported as needing drainage..... acres..	640, 479	3. 3
DRAINAGE ENTERPRISES.		
Approximate land area of the state..... acres..	26, 679, 680	100. 0
All land in operating drainage enterprises..... acres..	363, 671	1. 4
Improved land..... acres..	163, 218	0. 6
Timber and cut-over land..... acres..	189, 945	0. 7
Other unimproved land..... acres..	10, 508	(¹)
Capital invested in and required for completion of operating enterprises..	\$3, 447, 991	100. 0
Capital invested in these enterprises to Dec. 31, 1919.....	2, 925, 944	84. 9
Additional capital required to complete these enterprises.....	522, 047	15. 1

¹ Less than one-tenth of 1 per cent.

TENNESSEE

APPROXIMATE LOCATION AND AREA OF OPERATING DRAINAGE ENTERPRISES.



DRAINAGE ON FARMS.

Explanation of terms.—To secure uniformity in the returns relating to drainage on farms, the Bureau of the Census supplied its enumerators with certain definitions, which were substantially as follows:

Drainage of agricultural land was defined, for census purposes, as the act or process of drawing off an excess of water by underground conduits, pipes, or tiles, or by open or covered trenches in the surface of the ground, for the purpose of improving the condition of the soil and crops.

The area provided with drainage, in farms, includes the acreage actually benefited or made of more value for agricultural purposes by artificial drainage, but does not include land on which only temporary work has been done, such as "bedding" the fields or laying out "dead furrows" to hasten the surface flow.

The area needing drainage, in farms, comprises the additional land not now suitable for crops which could be made available for cultivation (1) "by drainage only," which is the acreage needing no clearing or which is covered with grass, weeds, or other annual growth, and (2) "by drainage and clearing," which is the acreage covered with trees, stumps, or perennial woody shrubs.

Improved land in farms includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled; land lying fallow, land in gardens, orchards, vineyards, and nurseries, and land occupied by farm buildings.

Woodland in farms includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

Farms in drainage and levee districts are those for which the operators answered affirmatively the question, "Has any part of this farm been afforded drainage or protection against overflow by a drainage or levee district, or by the state, the county, or a private company or individual?" Levee districts, however, are not generally included in the drainage enterprises for which data are given in this bulletin (see definition of drainage enterprises, below).

Farms and farm land.—The acreage shown for drainage on farms represents land where drainage is actually in operation and which has actually become more fully available for the growing of crops by reason of the drainage. This is to be distinguished from the area merely provided with drainage outlet facilities through the organization of drainage enterprises. Drainage on farms represents in some cases the result of work done independently by the farm owner, and in other cases work done on the farm to supplement the work of the drainage enterprise in which the farm is located.

DRAINAGE ENTERPRISES.

Explanation of terms.—The more important terms used in connection with the census of drainage enterprises were defined as follows:

Drainage enterprises comprise public corporations and local improvement districts formed under state laws, commercial enterprises draining swamp or overflowed lands for sale, any other organizations that may be engaged in extensive land-drainage work, and also tracts of 500 acres or more drained by individual owners. Enterprises such as levee districts that have not authorized the construction of open ditch or tile drains are not included.

Enterprises located in more than one county were divided, for tabulation, and the part in each county treated as a separate enterprise, though the capacities of pumping plants are given only in the counties in which the plants are located.

Operating enterprises, as designated in this bulletin, are those drainage enterprises that had completed the drainage works authorized, or had at any rate begun actual construction work, on or before January 1, 1920; enterprises that had been established but had not begun construction are termed "nonoperating."

Land in drainage enterprises comprises the area that has been benefited or is to be benefited by the improvement works constructed by the enterprises. In the case of overlapping enterprises, deduction has been made for the amount of duplication.

All land in drainage enterprises is divided, without regard to drainage condition, into (a) improved land; (b) timber and cut-over land, which would require clearing to be thoroughly fit for cultivation; and (c) all other unimproved land, which would not require expensive clearing before cultivation.

The assessed acreage for any single enterprise is the same as the area in that enterprise. However, the total assessed acreage may be greater than the total land in enterprises, for in summing up the assessed acreage in the county or state, deduction was not made for acreage assessed in more than one enterprise.

Improved land in drainage enterprises consists very largely of improved farm land, though it may include some other improved land receiving benefit from the works of the enterprises.

Timber and cut-over land includes farm woodland of natural or planted forest trees as well as other timber land or areas that would need clearing of trees, stumps, or perennial woody shrubs.

Land designated as swampy or subject to overflow includes all land permanently or generally too wet for cultivation, land subject to periodical inundation by stream floods, seeped and alkali land in irrigated regions, and all other land unfit for cultivation by reason of insufficient drainage. This classification is without respect to the conditions as to improvement or timber.

The area suffering loss of crops is intended to include only land devoted to planted crops, which suffer damage, either partial or complete, because of defective drainage. Land which would be cultivated if drained or protected against overflow is not included.

Capital invested, for the purpose of this investigation, was defined as cost, including charges for engineering, organization, rights of way, construction of drainage works, damages, land and buildings except those held for sale or farming, and any other expenditures properly chargeable to drainage and paid by the enterprise.

The drainage works of an enterprise include all varieties of underground conduits, pipes, or lines of tile, or drains of stone, wood, or other material; also open ditches and canals, together with accessory levees, dikes, dams, weirs, pumping machinery, gates, and other devices for the draining away or control of surface and soil waters.

Tile, as the term is here used, includes pipes of earthenware, concrete, or other material buried beneath the surface in such a way as to permit the excess water to flow away. The size, if circular, is expressed by the inside diameter in inches.

Ditches include all open artificial trenches, usually with sloping sides. The width is that of the bottom.

The type of drainage shows whether the drainage water from an enterprise is discharged by gravity or by pumping.

A **pumping district** is one where all or a part of the water from the drains collecting at a low point must be raised by some form of machinery in order that it may be removed from the area.

Drainage pumps include all kinds of machinery and devices for lifting the drainage water.

Pumping engines include all kinds of engines and motors for operating the drainage pumps.

Operating and nonoperating enterprises.—In most of the tables that follow, statistics are given for operating enterprises only. These enterprises, as already defined, include both those which have completed their drainage works and those with such works under construction; among the latter may be some that had completed the original plan of reclamation several years ago but were constructing extensions or enlargements on January 1, 1920. The nonoperating enterprises have a legal existence, though they have not yet accomplished any drainage. They may include districts that on the census date had completed their plans, sold bonds to cover the cost of the undertaking, and let contracts for the construction work, and also districts that had just been established by court decree and were still subject to considerable change in area, plan of drainage works, and cost.

TABLE 2.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED AS BETWEEN OPERATING AND NONOPERATING ENTERPRISES: 1920.

CLASS.	LAND.		CAPITAL. ¹		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	445,955	100.0	\$2,995,515	100.0	\$1,447,230
Operating enterprises.....	363,671	81.5	2,925,944	97.7	522,047
With works completed.....	268,667	60.2	2,283,589	76.2	.....
With works under construction..	95,004	21.3	642,355	21.4	522,047
Nonoperating enterprises.....	82,284	18.5	69,571	2.3	925,183

¹ The inquiry asked for the "total cost of the enterprise to December 31, 1919," and for an "estimate of additional investment to complete."

Location of enterprises.—The drainage enterprises in the state lie almost entirely west of the Tennessee River. Most of them are drained through the smaller tributaries of the Mississippi River—namely, Obion River, Forked Deer River, and Hatchee River; some are drained through Big Sandy River, Beech River, and a few of the creeks entering the Tennessee River.

TABLE 3.—LAND AND CAPITAL INVESTED IN ALL ENTERPRISES, CLASSIFIED BY DRAINAGE BASIN: 1920.

DRAINAGE BASIN.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All organized enterprises.....	445,955	100.0	\$2,995,515	100.0	\$1,447,230
Operating enterprises.....	363,671	81.5	2,925,944	97.7	522,047
Mississippi River.....	275,899	61.8	2,443,362	81.5	219,047
Tennessee and Cumberland Rivers.....	87,772	19.7	482,582	16.1	303,000
Nonoperating enterprises.....	82,284	18.5	69,571	2.3	925,183
Mississippi River.....	81,880	18.4	69,571	2.3	919,183
Tennessee and Cumberland Rivers.....	404	0.1	.....	.....	6,000

Condition of land in enterprises.—The enterprises generally are narrow strips bordering the streams, which in their natural condition are crooked and considerably obstructed. The resultant overflows cause damage to planted crops or keep the areas so wet that cultivation is not attempted until adequate drainage improvements have been provided. In the lower-lying counties near the Mississippi River, flood elevations in that stream cause "backwater" to overflow lands along its tributaries. The soils are mostly alluvial, and when drained are naturally of greater fertility than those on the higher land.

The usual purpose of an organized enterprise is merely to provide adequate outlets into which the landowners of the district may drain their farms, and to afford relief from overflow for the district as a unit. Therefore, the fact that an enterprise which has completed the construction of the drainage works authorized contains land still swampy or subject to overflow, or land that suffers damage to crops, does not show that the improvement works are inadequate.

TABLE 4.—LAND IN ALL ENTERPRISES, CLASSIFIED BY CONDITION: 1920.

CONDITION OF LAND.	OPERATING ENTERPRISES.				Non-operating enterprises (acres).
	Total.		Works completed (acres).	Works under construction (acres).	
	Acreage.	Per cent of all land.			
All land in enterprises.....	363,671	100.0	268,667	95,004	82,284
Improved land.....	163,218	44.9	135,284	27,934	23,116
Timber and cut-over land.....	189,945	52.2	129,538	60,409	57,160
Other unimproved land.....	10,508	2.9	3,847	6,661	2,008
Swampy or subject to overflow.....	104,063	28.6	21,631	82,432	76,004
Suffering a loss of crops.....	29,879	8.2	7,816	22,063	17,536

Size of enterprises.—Presentation of the statistics by counties requires that an enterprise located in more than one county be divided, and the part in each county be considered a separate enterprise. In this way 95 operating drainage enterprises are counted in Tennessee, with an average area of 3,828 acres. There are only 9 operating enterprises of 10,000 acres or more each, and there are 49 that comprise between 1,000 and 5,000 acres each. There is no overlapping of enterprises in this state.

TABLE 5.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY SIZE OF AREA ASSESSED: 1920.

AREA ASSESSED.	Land in enterprises (acres).	ASSESSED AREA.	
		Acreage.	Per cent of total.
All operating enterprises.....	363,671	363,671	100.0
Less than 200 acres.....	121	121	(¹)
200 to 499 acres.....	2,156	2,156	0.6
500 to 999 acres.....	12,465	12,465	3.4
1,000 to 4,999 acres.....	117,651	117,651	32.4
5,000 to 9,999 acres.....	91,612	91,612	25.2
10,000 to 49,999 acres.....	139,666	139,666	38.4
50,000 acres and over.....	.....	.....	.....

¹ Less than one-tenth of 1 per cent.

Character of enterprises.—All the present drainage enterprises, both operating and nonoperating, for agricultural land in Tennessee are public corporations organized under the general drainage district law of the state, approved April 28, 1909 (ch. 185). The statute applies to the whole state except Reelfoot Lake.

Drainage districts and levee districts are established by the county courts upon petition from one or more persons to be affected by the proposed improvement, if the work "will be of public utility or conducive to the public health or welfare." The affairs of the district are managed by a board of directors consisting of the judge or chairman of the county court and two persons owning or interested in lands of the district, appointed by the court. The cost of the enterprise is paid by the landowners in proportion to the benefits their lands will receive; the assessments are collected like county taxes. Provision is made for districts embracing land in two or more counties.

The petition must describe approximately the land to be affected and the location of the proposed drains. The court appoints an engineer to make a survey, and to report regarding the land to be affected and the plan of reclamation that will be of public benefit, with an estimate of the cost of the project. The court appoints viewers to make recommendations regarding claims for damages, if any are filed, and after establishing the district he appoints three commissioners to apportion the cost. Public hearings are held, upon the engineer's report and again upon the commissioners' report. Appeal from decisions of the county court may be taken to the circuit court. The board of directors lets the contract and carries out the improvement; it may issue bonds running not more than 20 years.

This law provides that the owners of the land to be affected by a drain or system of drains may agree among themselves regarding the location of the improvement works, the amounts of damages to be paid, and the apportionment of the cost, and file their agreement in writing with the clerk of the county, whereupon the county court will assume jurisdiction and complete the enterprise in accordance with the agreement and in the manner that the law provides for establishing drainage districts. This provision is practicable only where few land owners are interested, and has been used by enterprises embracing a total of 2,500 acres.

Subdistricts within a drainage district may be formed in the same manner as an original district. They will be administered by the board of directors of the drainage district, and assessments for the subdistrict will be secondary to those of the original district.

The first drainage law of Tennessee was enacted in 1842, providing relief for a landowner who could not

drain his own land without crossing that of another owner who refused permission for the necessary ditch. The aggrieved owner was permitted to petition the county court, which then would appoint a jury to assess the damages that should be paid for the privilege sought. The petitioner, after paying such damages, or offering payment, might construct and maintain the ditch.

Public drainage work evidently began as supplemental to flood protection by levees. In 1871 the counties were authorized, upon affirmative vote of three-fourths of the voters affected, to issue bonds to raise funds to build levees. In 1901 they were authorized to retain the increment of taxes received, by reason of enhanced value of taxable property resulting from levees and drainage constructed with funds raised by bond issues of the county, to apply upon the payment of such bonds.

Some special acts have been passed, before and since the drainage law of 1909 was enacted, permitting persons interested in overflowed lands to ditch and straighten certain streams, but the form of organization was not specified, and no enterprises were reported as organized under those special acts.

Drainage Works.—The total works completed by drainage enterprises to December 31, 1919, comprised 777.3 miles of open ditches, 0.3 mile of tile drains, and 42.3 miles of accessory levees; the additional lengths under construction were 135.4 miles of open ditches, 0.1 mile of tile drains, and 10.2 miles of levees. These figures do not include drains or levees installed by individual farm owners supplemental to the works of the enterprises, nor the works of flood-protection or levee districts that had not undertaken the construction of ditches or tile drains. There are no pumping districts for land drainage in Tennessee.

TABLE 6.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY KIND OF DRAINAGE WORKS: 1920.

KIND OF WORKS.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All kinds.....	363,671	100.0	\$2,925,944	100.4	\$522,047
Open ditches only.....	332,317	91.4	2,439,944	83.4	511,847
Open ditches and levees.....	30,854	8.5	481,060	16.4	7,700
Tile drains only.....	500	0.1	5,000	0.2	2,500

The average depth of the main or outlet ditch was reported for each enterprise. The maximum depth of outlet reported for any enterprise in the state and the maximum in each county are shown in line 15 of County Table II. The maximum length, width, and depth of outlet shown in that table for any county may not refer to the same enterprise.

County Table II, line 16, shows the mean depth of branch ditches, which is a very crude indication of the depth of soil drainage that may be obtained in the enterprises, as determined by the depth of outlet provided for farm drains. The mean depth was computed by giving each separate depth a weight in proportion to the acreage it serves. As most enterprises reported depths in whole numbers only, the occasional decimals were omitted in making these computations. Depths less than 3 feet were omitted because the area served is very small, and those of 10 feet and greater were omitted because it seemed that they did not represent so well the average depths of outlet provided for all the farms in those districts. To include both these groups, computed as 3 feet and 10 feet, respectively, would make the mean depth for the state 7.3 instead of 6.8 feet.

TABLE 7.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY AVERAGE DEPTH OF BRANCH DITCHES: 1920.

DEPTH OF BRANCH DITCHES.	Acreage.	Per cent of total.
All operating enterprises.....	363,671	100.0
Less than 3 feet.....	2,000	0.6
3.0 to 3.9 feet.....	6,700	1.8
4.0 to 4.9 feet.....	6,822	1.9
5.0 to 5.9 feet.....	81,300	22.4
6.0 to 6.9 feet.....	91,084	25.0
7.0 to 7.9 feet.....	56,708	15.6
8.0 to 8.9 feet.....	9,847	2.7
9.0 to 9.9 feet.....	45,844	12.5
10.0 feet and more.....	63,741	17.5
Not reporting branches.....		

Maintenance of Works (Table 8).—The general drainage law provides (act of April 3, 1915, chapter 63), that the board of directors of a drainage district may provide for keeping the drainage works in repair and free from obstructions, by levying a special assessment not to exceed in any year an amount equal to 10 cents per acre upon all the land in the district, and to be based upon the apportionment of the benefits made by the commissioners for apportioning the cost of original construction.

Date of Organization (Tables 9, 10, and 11).—The progress in drainage is shown only roughly by the dates of the organization of enterprises, which are the dates when the districts were established by the county courts, since there may be a period of a year or more between the decree of establishment and the beginning of actual construction, and since the work of construction may occupy several years in a large district. It was not practicable, however, for the census to secure data as to the time of the beginning or the completion of the drainage works. Under the date of organization are tabulated the entire area, works, and capital of each enterprise, even including extensions made after the original plan of reclamation was completed. No drainage enterprises were reported as organized in Tennessee earlier than 1910.

TABLE 8.—LAND AND CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY METHOD OF MAINTENANCE: 1920.

METHOD OF MAINTENANCE.	LAND.		CAPITAL.		
	Acreage.	Per cent of total.	To Dec. 31, 1919.		Additional required to complete.
			Amount.	Per cent of total.	
All operating enterprises.....	363,671	100.0	\$2,925,944	100.0	\$522,047
By district forces.....	216,559	59.5	1,564,859	53.5	463,200
By contract.....	98,810	27.2	891,474	30.5	23,990
By landowners.....	500	0.1	5,000	0.2	2,500
By other methods.....	600	0.2	7,015	0.2	
No maintenance provided.....	47,202	13.0	457,596	15.6	38,847

TABLE 9.—LAND IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	LAND.		AREA ASSESSED.	
	Acreage.	Per cent of total.	Acreage.	Per cent of total.
All operating enterprises.....	363,671	100.0	363,671	100.0
1910-1914.....	135,679	37.3	135,679	37.3
1915-1919.....	227,992	62.7	227,992	62.7

TABLE 10.—CAPITAL INVESTED IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	TO DEC. 31, 1919.		Additional required to complete.
	Amount.	Per cent of total.	
All operating enterprises.....	\$2,925,944	100.0	\$522,047
1910-1914.....	1,218,662	41.7	12,200
1915-1919.....	1,707,282	58.3	509,847

TABLE 11.—DRAINS AND LEVEES (COMPLETED AND UNDER CONSTRUCTION) IN OPERATING ENTERPRISES, CLASSIFIED BY DATE ENTERPRISE WAS ORGANIZED: 1920.

DATE OF ORGANIZATION.	DITCHES.		TILE.		LEVEES.	
	Miles.	Per cent of total.	Miles.	Per cent of total.	Miles.	Per cent of total.
All drains and levees.....	912.7	100.0	0.4	100.0	52.5	100.0
1910-1914.....	287.5	31.5	0.4	100.0	52.5	100.0
1915-1919.....	625.2	68.5				

Crops.—The principal crops grown upon the drained land in drainage enterprises are corn and cotton. Data were not secured to show the part of each enterprise planted to any crop, so the enterprises have been classified according to the principal crop, and the total area of improved land is shown thus classified, in County Table II. No data were secured at the general census of agriculture, to separate the crops grown upon land drained artificially from those produced upon land drained naturally.

DRAINAGE-TENNESSEE

7

COUNTY TABLE I.—DRAINAGE ON FARMS: 1920.

		The State.	Bedford.	Benton.	Carroll.	Chester.	Cooke.	Crockett.	Decatur.
1	Number of all farms in the state or county.....	252,774	3,340	1,938	4,141	1,667	2,800	3,072	1,813
2	Farms reporting land having drainage.....	8,887	330	277	249	316	114	220	373
3	Farms reporting land needing drainage.....	20,997	387	579	415	462	449	131	394
4	Farms in drainage and levee districts.....	2,669	4	2	261	163	4	227	1
LAND AND FARM AREA.									
5	Approximate land area of the state or county.....	acres. 26,679,680	328,960	291,840	396,160	200,320	278,280	170,880	184,320
6	All land in farms.....	acres. 19,519,856	283,605	203,781	332,123	151,830	218,463	147,308	169,375
7	Improved land in farms.....	acres. 11,185,302	201,279	80,407	165,804	62,713	110,390	117,070	64,609
8	Woodland in farms.....	acres. 7,080,169	70,259	104,210	108,409	62,118	96,320	26,851	90,677
9	Other unimproved land in farms.....	acres. 1,245,385	12,067	19,164	57,910	26,909	2,753	2,787	14,689
10	Farm land reported as provided with drainage.....	acres. 254,118	5,584	4,781	9,577	8,248	2,895	7,168	7,400
11	Farm land reported as needing drainage.....	acres. 640,479	6,172	20,809	14,503	14,042	18,670	6,029	12,443
12	Drainage only.....	acres. 76,044	1,644	1,386	2,800	1,720	326	1,205	1,630
13	Drainage and clearing.....	acres. 563,835	4,528	19,414	12,263	12,322	18,351	4,824	10,813

		Dyer.	Fayette.	Franklin.	Gibson.	Greene.	Hamilton.	Hardeman.	Hardin.	Hawkins.
1	Number of all farms in the county.....	3,022	5,875	2,230	6,585	5,313	1,564	3,535	2,907	3,314
2	Farms reporting land having drainage.....	220	7	110	377	177	58	105	336	119
3	Farms reporting land needing drainage.....	159	222	418	631	498	38	258	329	96
4	Farms in drainage and levee districts.....	127	1	2	420	4		18	182	10
LAND AND FARM AREA.										
5	Approximate land area of the county.....	acres. 320,000	395,520	308,000	405,120	392,320	101,120	446,080	372,480	308,480
6	All land in farms.....	acres. 199,198	355,523	214,252	330,804	345,728	109,205	333,857	280,037	280,328
7	Improved land in farms.....	acres. 158,323	236,785	129,426	251,837	245,593	83,480	144,215	109,490	181,460
8	Woodland in farms.....	acres. 39,274	78,937	69,023	59,957	86,740	22,219	136,320	106,553	96,102
9	Other unimproved land in farms.....	acres. 1,601	39,801	15,803	19,010	13,395	3,504	50,322	13,988	8,766
10	Farm land reported as provided with drainage.....	acres. 7,891	384	2,056	10,709	4,118	1,481	3,788	6,848	3,922
11	Farm land reported as needing drainage.....	acres. 5,840	5,743	12,859	20,500	8,270	572	13,832	7,011	2,107
12	Drainage only.....	acres. 1,287	463	659	1,098	1,012	195	1,710	2,143	619
13	Drainage and clearing.....	acres. 4,553	5,285	12,200	18,502	6,358	377	11,622	4,895	1,488

		Haywood.	Henderson.	Henry.	Hickman.	Jefferson.	Lake.	Lauderdale.	McNairy.	Madison.
1	Number of all farms in the county.....	4,359	3,290	4,286	1,923	2,209	850	3,406	3,263	4,467
2	Farms reporting land having drainage.....	43	726	134	59	62	16	83	412	94
3	Farms reporting land needing drainage.....	230	694	600	113	61	205	65	517	205
4	Farms in drainage and levee districts.....	72	248	124		1	23	81	145	98
LAND AND FARM AREA.										
5	Approximate land area of the county.....	acres. 325,120	343,040	400,640	364,800	199,080	78,080	291,840	376,320	353,280
6	All land in farms.....	acres. 207,711	300,632	349,597	235,045	182,477	60,250	173,437	283,843	305,017
7	Improved land in farms.....	acres. 159,717	140,300	192,247	97,899	135,552	52,619	122,735	117,054	179,052
8	Woodland in farms.....	acres. 37,645	108,031	115,508	120,057	41,585	7,122	47,158	140,587	88,350
9	Other unimproved land in farms.....	acres. 10,349	51,641	41,762	17,089	6,340	599	3,544	19,602	38,215
10	Farm land reported as provided with drainage.....	acres. 2,751	10,194	5,192	765	2,642	490	2,707	3,355	6,796
11	Farm land reported as needing drainage.....	acres. 7,404	21,674	24,477	1,931	2,037	6,523	7,892	15,049	8,303
12	Drainage only.....	acres. 432	3,896	5,973	98	210	3,506	1,912	2,298	508
13	Drainage and clearing.....	acres. 6,972	17,778	18,504	1,863	1,827	3,017	5,980	13,351	7,795

		Marion.	Meigs.	Montgomery.	Obion.	Roane.	Rutherford.	Sumner.	Weaver.	All other counties. ¹
1	Number of all farms in the county.....	1,037	935	4,121	3,378	1,687	5,294	4,585	5,050	144,598
2	Farms reporting land having drainage.....	104	38	118	716	156	170	26	418	2,115
3	Farms reporting land needing drainage.....	128	19	202	534	406	222	383	362	10,135
4	Farms in drainage and levee districts.....			25	138	1	2	2	198	85
LAND AND FARM AREA.										
5	Approximate land area of the county.....	acres. 314,240	127,360	330,240	353,280	248,320	392,960	357,120	371,200	10,497,280
6	All land in farms.....	acres. 114,882	124,528	317,968	296,797	180,463	361,906	318,559	318,104	11,467,625
7	Improved land in farms.....	acres. 50,812	65,281	222,095	224,632	90,607	222,056	225,666	225,397	6,308,424
8	Woodland in farms.....	acres. 55,293	54,666	66,000	70,686	79,792	120,169	60,893	75,391	4,519,777
9	Other unimproved land in farms.....	acres. 8,777	4,571	29,878	2,079	10,064	19,681	23,000	17,316	639,424
10	Farm land reported as provided with drainage.....	acres. 1,978	1,284	3,874	55,183	2,413	4,459	483	21,061	30,041
11	Farm land reported as needing drainage.....	acres. 3,018	407	6,373	22,293	9,779	3,706	6,641	13,792	309,616
12	Drainage only.....	acres. 531	182	983	3,357	1,597	1,917	426	3,866	23,783
13	Drainage and clearing.....	acres. 2,487	225	5,390	18,936	8,182	1,789	6,215	9,926	285,833

¹ No drainage reported in Dickson, Houston, Lewis, and Van Buren Counties.

DRAINAGE—TENNESSEE.

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920.

		THE STATE.	Carroll.	Chester.	Crockett.	Dyer.	Fayette.	Gibson.	Hard- man.
LAND AREA.									
1	Approximate land area of the state or county.....	acres.. 26,679,680	396,160	200,320	170,880	320,000	305,520	405,120	446,086
2	All land in operating drainage enterprises.....	acres.. 363,671	33,724	13,125	17,282	43,106	1,928	46,484	5,542
3	Improved land.....	acres.. 163,218	8,043	8,422	8,669	18,853	1,169	22,951	2,201
4	Per cent of all improved land in farms.....	1.5	4.9	13.4	7.4	11.9	0.5	9.1	1.5
5	Timber and cut-over land.....	acres.. 189,945	24,971	4,703	8,613	24,253	759	23,533	3,341
6	Other unimproved land.....	acres.. 10,508	710						
7	Swampy or subject to overflow in enterprises.....	acres.. 104,063	5,832	1,112		25,000	121	948	3,194
8	Suffering loss of crops from defective drainage.....	acres.. 29,879	1,771			8,000	121	474	97
9	Assessed acreage.....	363,671	33,724	13,125	17,282	43,106	1,928	46,484	5,542
10	Excess over all land in operating enterprises.....	acres..							
DRAINAGE WORKS.									
Open ditches:									
11	Completed.....	miles.. 777.3	114.9	61.8	39.5	71.2	5.0	79.3	17.6
12	Additional under construction.....	miles.. 135.4	21.3	0.7		10.5	0.5		5.5
13	Maximum completed in any enterprise.....	miles.. 55.0	55.0	24.5	10.6	20.0	2.8	26.2	7.0
14	Maximum width, at bottom of ditch.....	feet.. 80	30	28	70	80	12	30	15
15	Maximum of average depths of outlet ditches.....	feet.. 16.0	12.0	12.0	15.0	16.0	7.5	11.0	8.0
16	Mean depth of branch ditches.....	feet.. 6.8	6.2	7.0	7.2	7.8	6.0	7.2	6.0
Tile drains:									
17	Completed.....	miles.. 0.3							
18	Additional under construction.....	miles.. 0.1							
19	Maximum completed in any enterprise.....	miles.. 0.3							
20	Maximum size of tile.....	inches.. 10							
Accessory levees and dikes:									
21	Completed.....	miles.. 42.3							
22	Additional under construction.....	miles.. 10.2							
23	Area drained by open ditches only.....	acres.. 332,317	33,724	13,125	17,282	43,106	1,928	46,484	5,542
24	Length of these ditches.....	miles.. 862.2	136.2	62.5	39.5	81.7	5.5	79.3	23.1
25	Average length per acre.....	feet.. 13.7	21.3	25.1	12.1	10.0	15.1	9.0	22.0
26	Area having both open ditches and levees.....	acres.. 30,854							
27	Length of these ditches.....	miles.. 50.5							
28	Average length per acre.....	feet.. 8.0							
29	Length of these accessory levees.....	miles.. 52.5							
30	Area drained by tile only.....	acres.. 500							
31	Length of these tile.....	miles.. 0.4							
32	Average length per acre.....	feet.. 4.0							
DEVELOPMENT OF LAND.									
33	Improved land in operating enterprises, 1920.....	acres.. 163,218	8,043	8,422	8,669	18,853	1,169	22,951	2,201
34	Improved land prior to drainage.....	acres.. 86,028	2,110	3,725	4,379	13,321	618	12,003	1,221
35	Increase since drainage.....	acres.. 77,190	5,933	4,697	4,290	5,532	551	10,948	980
36	Per cent of increase.....	89.7	279.6	126.1	98.0	41.5	80.2	91.2	80.3
37	Per cent increase is of all improved land in farms, 1920.....	0.7	3.6	7.5	3.6	3.5	0.2	4.3	0.7
38	Timber and cut-over land, 1920.....	acres.. 189,945	24,971	4,703	8,613	24,253	759	23,533	3,341
39	Timber and cut-over land prior to drainage.....	acres.. 262,163	30,895	9,116	12,903	29,785	1,310	34,481	4,321
40	Decrease since drainage.....	acres.. 72,218	5,924	4,413	4,290	5,532	551	10,948	980
41	Per cent of decrease.....	27.5	19.1	48.4	33.2	18.6	42.1	31.8	22.7
42	Other unimproved land, 1920.....	acres.. 10,508	710						
43	Other unimproved land prior to drainage.....	acres.. 15,480	710						
44	Decrease since drainage.....	acres.. 4,972							
45	Per cent of decrease.....	32.1		100.0					
46	Swampy or subject to overflow, 1920.....	acres.. 104,063	5,832	1,112		25,000	121	948	3,194
47	Swampy or subject to overflow prior to drainage.....	acres.. 353,027	33,724	13,125	16,782	43,106	1,928	36,806	5,542
48	Decrease since drainage.....	acres.. 248,964	27,892	12,013	16,782	18,106	1,807	35,858	2,348
49	Per cent of decrease.....	70.5	82.7	91.5	100.0	42.0	93.7	97.4	42.4
CAPITAL INVESTED AND COST PER ACRE.									
50	Total capital invested in and required for completion of operating enterprises.....	dollars.. 3,447,991	360,566	125,941	179,355	466,011	15,660	328,095	45,117
51	Capital invested in these enterprises to Dec. 31, 1919.....	dollars.. 2,925,944	310,216	124,946	179,355	346,511	14,451	328,095	36,915
52	Additional capital required to complete these enterprises.....	dollars.. 522,047	50,350	995		119,500	1,209		8,202
53	Average cost per acre, when completed.....	dollars.. 9.48	10.69	9.60	10.38	10.81	8.12	7.06	8.14
54	Enterprises constructing open ditches only.....	dollars.. 2,951,791	360,566	125,941	179,355	466,011	15,660	328,095	45,117
55	Average cost per acre, when completed.....	dollars.. 8.88	10.69	9.60	10.38	10.81	8.12	7.06	8.14
56	Enterprises constructing open ditches and levees.....	dollars.. 488,700							
57	Average cost per acre, when completed.....	dollars.. 15.84							
58	Enterprises constructing tile drains only.....	dollars.. 7,500							
59	Average cost per acre, when completed.....	dollars.. 15.00							
CROPS.									
60	Improved land in enterprises reporting—								
61	Corn as principal crop on drained land.....	acres.. 110,022	7,895	8,119	3,535	10,128		22,951	2,201
	Cotton as principal crop on drained land.....	acres.. 53,196	348	803	5,134	8,725	1,169		

* When works under construction have been completed.

DRAINAGE—TENNESSEE.

9

COUNTY TABLE II.—OPERATING DRAINAGE ENTERPRISES: 1920—Continued.

		Hardin.	Hay-wood.	Hender-son.	Henry.	McNairy.	Madison.	Obion.	Other counties. ¹	
LAND AREA.										
1	Approximate land area of the county.....	acres..	372,480	325,120	343,040	400,640	376,320	353,280	353,280	1,642,240
2	All land in operating drainage enterprises.....	acres..	10,345	35,334	20,684	31,589	12,729	23,174	27,160	32,405
3	Improved land.....	acres..	11,334	20,059	11,433	6,800	7,041	11,727	13,670	10,840
4	Per cent of all improved land in farms.....	.....	10.4	12.5	8.1	3.5	6.0	6.5	6.1	0.2
5	Timber and cut-over land.....	acres..	8,011	15,275	8,655	21,600	5,688	11,447	13,484	15,552
6	Other unimproved land.....	acres..	.....	.....	596	3,129	.....	.....	.....	6,073
7	Swampy or subject to overflow in enterprises.....	acres..	4,045	1,480	2,658	24,454	.....	1,154	18,252	15,813
8	Loss of crops from defective drainage.....	acres..	700	592	1,614	5,256	.....	.....	7,551	3,703
9	Assessed acreage.....	acres..	19,345	35,334	20,684	31,589	12,729	23,174	27,160	32,405
10	Excess over all land in operating enterprises.....	acres..	.....	.....	.....	.....	.....	.....	.....	.....
DRAINAGE WORKS.										
Open ditches:										
11	Completed.....	miles..	44.6	58.3	64.2	35.5	52.2	48.8	58.0	26.4
12	Additional under construction.....	miles..	.....	5.9	5.0	70.7	1.3	.....	.....	14.0
13	Maximum completed in any enterprise.....	miles..	9.0	17.4	13.0	19.5	12.0	15.0	29.0	16.0
14	Maximum width, at bottom of ditch.....	feet..	24	50	30	45	20	45	47	70
15	Maximum of average depths of outlet ditches.....	feet..	12.0	15.0	12.0	10.0	8.0	11.0	10.0	11.0
16	Mean depth of branch ditches.....	feet..	8.0	6.4	6.8	6.1	6.0	7.2	8.0	7.0
Tile drains:										
17	Completed.....	miles..	.....	.....	.....	.....	.....	.....	.....	0.3
18	Additional under construction.....	miles..	.....	.....	.....	.....	.....	.....	.....	0.1
19	Maximum completed in any enterprise.....	miles..	.....	.....	.....	.....	.....	.....	.....	0.4
20	Maximum size of tile.....	inches..	.....	.....	.....	.....	.....	.....	.....	10
Accessory levees and dikes:										
21	Completed.....	miles..	.....	.....	.....	.....	.....	13.8	.....	28.5
22	Additional under construction.....	miles..	.....	.....	.....	.....	.....	10.2	.....	.....
23	Area drained by open ditches only.....	acres..	19,345	35,334	20,684	31,589	12,729	23,174	5,900	22,371
24	Length of these ditches.....	miles..	44.6	64.2	69.2	100.2	53.5	48.8	16.0	31.9
25	Average length per acre.....	feet..	12.2	9.0	17.6	17.7	22.2	11.1	14.8	7.5
26	Area having both open ditches and levees.....	acres..	.....	.....	.....	.....	.....	21,260	.....	9,594
27	Length of these ditches.....	miles..	.....	.....	.....	.....	.....	42.0	.....	8.5
28	Average length per acre.....	feet..	.....	.....	.....	.....	.....	10.4	.....	4.7
29	Length of these accessory levees.....	miles..	.....	.....	.....	.....	.....	24.0	.....	28.5
30	Area drained by tile only.....	acres..	.....	.....	.....	.....	.....	.....	.....	500
31	Length of these tile.....	miles..	.....	.....	.....	.....	.....	.....	.....	0.4
32	Average length per acre.....	feet..	.....	.....	.....	.....	.....	.....	.....	4.0
DEVELOPMENT OF LANDS.										
33	Improved land in operating enterprises, 1920.....	acres..	11,334	20,059	11,433	6,800	7,041	11,727	13,670	10,840
34	Improved land prior to drainage.....	acres..	2,008	10,830	6,854	6,005	3,611	3,757	7,865	7,112
35	Increase since drainage.....	acres..	9,326	9,229	4,579	195	3,430	7,970	5,811	3,728
36	Per cent of increase.....	.....	464.4	85.2	66.8	3.0	95.0	212.1	73.9	52.4
37	Per cent increase is of all improved land in farms, 1920.....	.....	8.5	5.8	3.3	0.1	2.9	4.4	2.6	0.4
38	Timber and cut-over land, 1920.....	acres..	8,011	15,275	8,655	21,600	5,688	11,447	13,484	15,552
39	Timber and cut-over land prior to drainage.....	acres..	15,357	24,504	11,166	21,855	9,118	19,417	19,295	18,640
40	Decrease since drainage.....	acres..	7,346	9,229	2,511	195	3,430	7,970	5,811	3,088
41	Per cent of decrease.....	.....	47.8	37.7	22.5	0.9	37.6	41.0	30.1	16.6
42	Other unimproved land, 1920.....	acres..	.....	.....	596	3,129	.....	.....	.....	6,073
43	Other unimproved land prior to drainage.....	acres..	1,980	.....	2,664	3,129	.....	.....	.....	6,713
44	Decrease since drainage.....	acres..	1,980	.....	2,068	.....	.....	.....	.....	640
45	Per cent of decrease.....	.....	100.0	.....	77.6	.....	.....	.....	.....	9.5
46	Swampy or subject to overflow, 1920.....	acres..	4,045	1,480	2,658	24,454	.....	1,154	18,252	15,813
47	Swampy or subject to overflow prior to drainage.....	acres..	19,345	35,334	20,684	31,589	12,729	22,833	27,160	32,340
48	Decrease since drainage.....	acres..	15,300	33,854	18,026	7,135	12,729	21,679	8,908	16,527
49	Per cent of decrease.....	.....	79.1	95.8	87.1	22.6	100.0	94.9	32.8	51.1
CAPITAL INVESTED AND COST PER ACRE.										
50	Total capital invested in and required for completion of operating enterprises.....	dollars..	95,210	221,742	188,576	327,791	114,387	185,585	400,450	393,505
51	Capital invested in these enterprises to Dec. 31, 1919.....	dollars..	95,210	206,951	175,076	110,975	112,737	185,585	392,750	300,171
52	Additional capital required to complete these enterprises.....	dollars..	.....	14,791	13,500	210,816	1,650	.....	7,700	93,334
53	Average cost per acre, when completed.....	dollars..	4.92	6.28	9.12	10.38	8.99	8.01	14.74	12.12
54	Enterprises constructing open ditches only.....	dollars..	95,210	221,742	188,576	327,791	114,387	185,585	71,750	226,005
55	Average cost per acre, when completed.....	dollars..	4.92	6.28	9.12	10.38	8.99	8.01	12.16	10.10
56	Enterprises constructing open ditches and levees.....	dollars..	.....	.....	.....	.....	.....	.....	328,700	160,000
57	Average cost per acre, when completed.....	dollars..	.....	.....	.....	.....	.....	.....	15.46	16.68
58	Enterprises constructing tile drains only.....	dollars..	.....	.....	.....	.....	.....	.....	.....	7,800
59	Average cost per acre, when completed.....	dollars..	.....	.....	.....	.....	.....	.....	.....	15.00
CROPS.										
60	Improved land in enterprises reporting—	acres..	11,120	.....	9,833	0,800	1,875	5,085	13,076	7,004
61	Corn as principal crop on drained land.....	acres..	214	20,059	1,600	.....	5,166	6,642	.....	3,836

¹ Includes only Benton, Lauderdale, Montgomery, Sumner, and Weakley Counties.² When works under construction have been completed.